Subject Categories

AERONAUTICS For related information see also *Astronautics.*

ASTRONAUTICS For related information see also *Aeronautics.*

N.A. — No abstracts were assigned to this category for this issue.

CHEMISTRY AND MATERIALS

ENGINEERING

N.A. — No abstracts were assigned to this category for this issue.

GEOSCIENCES

LIFE SCIENCES

MATHEMATICAL AND COMPUTER SCIENCES

N.A. — No abstracts were assigned to this category for this issue.

PHYSICS

SOCIAL SCIENCES

SPACE SCIENCES

N.A. — No abstracts were assigned to this category for this issue.

93 SPACE RADIATION **N.A.**

Includes cosmic radiation; and inner and outer earth's radiation belts. For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics.*

GENERAL

99 GENERAL **N.A.**

Includes aeronautical, astronautical, and space science related histories, biographies, and pertinent reports too broad for categorization; histories or broad overviews of NASA programs.

N.A. — No abstracts were assigned to this category for this issue.

Typical Report Citation and Abstract

❶ **19990032467** York Univ., Dept. of Electronics, UK
❷ **TIME DOMAIN IDENTIFICATION OF HELICOPTERS: A NEW PERSPECTIVE**
❸ Clarke, T., York Univ., UK; System Identification for Integrated
❹ Aircraft Development and Flight Testing; March 1999, pp. 21-1 – 21-9; In English; See also 19990032449
❺ Contract(s)/Grant(s): EPSRC-GR/H80989; Copyright Waived;
❻ Avail: CASI; A02, Hardcopy; A04, Microfiche
❼ The time-domain, observer-Kalman filter/eigensystem realization algorithm is successfully applied to the problem of generating a minimal state space model realization from a non-linear Lynx helicopter model. A linear realization is generated which gives a better representation of the non-linear model than that obtained using small perturbation linearization methods. The approach can be used to extract an unstable model from the flight data of a closed-loop stabilized system, even when the feedback dynamics are not precisely known.
❽ Author
❾ *Feedback Control; Helicopters; System Identification; Mathematical Models; Algorithms; Time Domain Analysis*

Key

1. Document ID Number; Corporate Source and Location
2. Title
3. Author and Affiliation; Conference/Publication Name
4. Publication Date; Other Pub. Info. Including Parent/Subsidiary ID Numbers
5. Report/Contract Number(s)
6. Availability Information Including Price Codes and Media
7. Abstract
8. Abstract Author
9. Subject Terms

RTO INDEX OF PUBLICATIONS (1999-2001)
ABSTRACT SECTION

01
AERONAUTICS (GENERAL)

20000012172 Research and Technology Organization, Systems Concepts and Integration Panel, Neuilly-sur-Seine, France
6TH SAINT PETERSBURG INTERNATIONAL CONFERENCE ON INTEGRATED NAVIGATION SYSTEMS ***[6EME CONFERENCE INTERNATIONALE DE SAINT PETERSBOURG SUR LES SYSTEMES DE NAVIGATION INTEGREE]***
6th Saint Petersburg International Conference on Integrated Navigation Systems; October 1999; 280p; In English; 6th Integrated Navigation Systems; 24-26 May 1999, Saint Petersburg, Russia; Sponsored by Academy of Sciences (Russia), Russia; Sponsored by State Research Center of the Russian Federation-Central Scientific and Research Inst. Elektropribor, Russia; See also 20000012173 through 20000012197; Original contains color illustrations
Report No.(s): RTO-MP-43; AC/323(SCI)TP/13; ISBN 92-837-1018-5; Copyright Waived; Avail: CASI; A13, Hardcopy; A03, Microfiche

The 6th Saint Petersburg International Conference on Integrated Navigation Systems was held on the 24-26 of May. It was organized this year by the Scientific Council of the Russian Academy of Sciences on the Problems of Motion Control and Navigation with the participation of the Research and Technology Organization of NATO. The Conference was sponsored by the State Research Center of the Russian Federation-Central Scientific and Research Institute 'Elektropribor'. This international conference, which is held annually in Saint Petersburg, brought together some 150 engineers and scientists from 17 different countries. The Conference was co-chaired by Prof. Vladimir G. Peshekhonov, (Russia), and Dr. John Niemela (USA). The Conference was organized into 4 sessions covering the main topics involved in integrated navigation systems and their applications: 1) Inertial Sensors and Systems; 2) Satellite Navigation; 3) SatNav/INS (Satellite Navigation/Integrated Navigation Systems) Technology; and 4) Integrated Navigation.
Derived from text
Conferences; Satellite Navigation Systems; Algorithms; Inertial Navigation

20000032683 Research and Technology Organization, Human Factors and Medicine, Neuilly-sur-Seine, France
HUMAN CONSEQUENCES OF AGILE AIRCRAFT ***[CYCLE DE CONFERENCES SUR LES FACTEURS HUMAINS LIES AU PILOTAGE DES AVIONS DE COMBAT TRES MANOEUVRANTS]***
March 2000; 92p; In English; 20-21 Mar. 2000, Neubiberg, Germany; 23-24 Mar. 2000, Preston, UK; 19-20 Oct. 2000, Ohio, USA; See also 20000032684 through 20000032689
Report No.(s): RTO-EN-12; AC/323(HFM)TP/32; ISBN 92-837-1036-3; Copyright Waived; Avail: CASI; A05, Hardcopy; A01, Microfiche; C01, CD-ROM

This Lecture Series evaluates the human factors implications for pilots of 'superagile flight', specifically with regard to agile airframes, agile weapons, and rapidly configurable systems. During interviews, experienced pilots have confirmed the operational need for military aircraft agility. Although pilots have noted that their experiences to date have not caused them any major concerns regarding the potential for physiological problems, significant gaps remain in our understanding of the effects of multi-axis accelerations. Human consequences are also anticipated in the area of situational awareness. Presentation of aircraft attitude and energy state in a helmet mounted display will be a design challenge. The minimal constraints on aircraft incidence angles and the expanded weapon launch envelopes anticipated with the forthcoming and next generations of air systems requires the provision of novel displays to enable pilots to effectively operate such air systems. Decision aids, intelligent interfaces and automated subsystems are required to enable pilots to maintain situational awareness whilst coping with dramatic increases in the tempo of the tactical situation and the 'data deluge'. Moreover, many of the current pilot protection systems will be inadequate for everyday use in such an unconstrained flight envelope and during ejection. Additional challenges in selection, simulation, and training are also anticipated.
Derived from text
Human Factors Engineering; Decision Support Systems; Aircraft Pilots; Pilot Training; Lectures; Human-Computer Interface

20000032685 Office National d'Etudes et de Recherches Aerospatiales, System Control and Flight Dynamics Dept., Salon Air, France
AGILITY: HISTORY, DEFINITIONS AND BASIC CONCEPTS
LeBlaye, Patrick, Office National d'Etudes et de Recherches Aerospatiales, France; Human Consequences of Agile Aircraft; March 2000, pp. 2 - 1 - 2 - 13; In English; See also 20000032683; Copyright Waived; Avail: CASI; A03, Hardcopy

The purpose of this presentation is to provide some engineering basis of the concept of agility. We'll see that the definition of agility has evolved across recent aviation history, from the well known area of airframe agility to a global concept of operational agility. We'll give some consensus definition, some of which have been proposed by the working group 19 of the Flight Mechanics Panel of AGARD. We'll briefly examine the concepts of agility relative to each component of the system (airframe, systems, weapons) and give some orders of magnitude of present and future weapon systems performances, which may have particular consequences on the human in flight. We'll then examine the concept of operational agility and conclude with some perspectives for potential areas of preoccupation relative to the role of human pilots in the future combat scenarios and information environment.
Author
Aircraft Performance; Aircraft Maneuvers; Flight Characteristics; Flight Mechanics; Flight Control

20000032859 Research and Technology Organization, Applied Vehicle Technology, Neuilly-sur-Seine, France
APPLICATION OF DAMAGE TOLERANCE PRINCIPLES FOR IMPROVED AIRWORTHINESS OF ROTORCRAFT ***[L'APPLICATION DES PRINCIPES DE LA TOLERANCE A L'ENDOMMAGEMENT POUR UNE MEILLEURE APTITUDE AU VOL DES AERONEFS AND VOILURE TOURNANTE]***
February 2000; 202p; In English; 21-22 Apr. 1999, Corfu, Greece; See also 20000032860 through 20000032874
Report No.(s): RTO-MP-24; AC/323(AVT)TP/12; ISBN 92-837-1024-X; Copyright Waived; Avail: CASI; A10, Hardcopy; A03, Microfiche; C01, CD-ROM

The Specialists' Meeting dealt with Aging Systems and more specifically Application of Damage Tolerance Principles for Improved Airworthiness of Rotorcraft. These proceedings include a Keynote Address and fifteen papers having the objective of discussing and presenting the applicability of the new design approach to major rotorcraft components such as the dynamic system, primary load carrying structures, and flight control systems. Both metal and composite structures including special material related topics such as crack growth models and delamination modelling were examined. There were three sessions covering the following topics: Material Data and Crack Growth Models for DT-Approaches fo Helicopter Structures; Design Application of DT-Principle; and Operator Experience and Certification Issues. A Technical Evaluation Report of this meeting is also included.
Author
Conferences; Rotary Wing Aircraft; Aircraft Reliability; Damage; Tolerances (Mechanics); Fatigue (Materials); Aircraft Structures; Systems Health Monitoring; Structural Reliability; Structural Failure

20000037804 Research and Technology Organization, Systems Concepts and Integration Panel, Neuilly-sur-Seine, France
ADVANCES IN VEHICLE SYSTEMS CONCEPTS AND INTEGRATION ***[LES AVANCEES EN CONCEPTS SYSTEMES POUR VEHICULES ET EN INTEGRATION]***
April 2000; 400p; In English; In French; 26-28 Apr. 1999, Ankara,

Turkey; See also 20000037805 through 20000037844; CD-ROM contains full text document in PDF format
Report No.(s): RTO-MP-44; AC/323(SCI)TP/17; ISBN 92-837-0011-2; Copyright Waived; Avail: CASI; A17, Hardcopy; A04, Microfiche; C01, CD-ROM

The meeting proceedings from this joint symposium on 'Advances in Vehicle Systems Concepts and Integration' contain the Technical Evaluation Reports and papers presented at Symposium (A) on 'Aircraft Update Programmes, The Economical Alternative?' and at Symposium (B) on 'Warfare Automation: Procedures and Techniques for Unmanned Vehicles'. It was organized by the Systems Concepts and Integration (SCI) Panel of the RTA in Ankara, Turkey from 26 to 28 April 1999. Symposium (A) was structured in five sessions covering Cockpit, Sensors, Engine, Overview and Lessons Learned (Part I and Part II) and was concluded by a panel discussion. Symposium (B) was structured in four sessions covering Operational requirements for unmanned vehicles, Integration aspects and mission management, Platform management and critical technologies and System concepts and mission experience.
Derived from text
Conferences; Warfare; Upgrading; Economics; Aircraft Engines; Avionics; Systems Engineering; Human-Computer Interface; Pilotless Aircraft; Human Factors Engineering

20000037811 Textron Bell Helicopter, Fort Worth, TX USA
STRATEGY FOR LONG-TERM SYSTEMS AND TECHNOLOGY ADVANCEMENT
Vaught, F. C., Textron Bell Helicopter, USA; Giles, L. B., Textron Bell Helicopter, USA; Advances in Vehicle Systems Concepts and Integration; April 2000, pp. A13-1 - A13-13; In English; See also 20000037804; Copyright Waived; Avail: CASI; A03, Hardcopy

Many challenges have emerged within the past five years for both military customers, as they plan for and purchase aircraft, and for manufacturers, in producing these aircraft. Opportunities to develop new models of military rotorcraft have decreased with steady reductions in military budgets and the post cold-war environment. These budget reductions, coupled with quantum advances in computing technologies that have advanced ground-based and airborne processing power, have shifted the focus of military customers from new model development to increased aircraft performance via system upgrades and training.
Author
Upgrading; Aircraft Performance; Aircraft Industry; Systems Engineering

20000037887 Research and Technology Organization, Neuilly-sur-Seine, France
DEVELOPMENT AND OPERATION OF UAVS FOR MILITARY AND CIVIL APPLICATIONS *[DEVELOPPEMENT ET UTILISATION DES AVIONS SANS PILOTE (UAV) POUR DES APPLICATIONS CIVILES ET MILITAIRES]*
April 2000; 311p; In English; 13-17 Sep. 1999, Rhode-Saint-Genese, Belgium; See also 20000037888 through 20000037899; CD-ROM contains full text document in PDF format
Report No.(s): RTO-EN-9; AC/323(AVT)TP/24; ISBN 92-837-1033-9; Copyright Waived; Avail: CASI; A14, Hardcopy; A03, Microfiche; C01, CD-ROM

Lecture Notes for the RTO Applied Vehicle Panel (AVT) Special Course on 'Development and Operation of UAVs for Military and Civil Applications' have been assembled in this report. The following topics were covered: Overview of current UAV systems and potential for the future, Design and airworthiness requirements, Propulsion systems, Airbreathing propulsion for UVAVs, Microflyers, Experimental research at low Reynolds numbers, Payloads and sensors, Datalinks, Airspace policy, Air traffic management and Tools for software and system architecture validation. The material assembled in this report was prepared under the combined sponsorship of the RTO Applied Vehicle Technology Panel, the Consultant and Exchange Programme of RTO, the von Karman Institute for Fluid Dynamics (VKI), and the NATO Partnership for Peace Programme.
Author
Airspace; Air Traffic Control; Command And Control; Architecture (Computers); Air Breathing Engines; Propulsion System Configurations; Fluid Dynamics; Pilotless Aircraft

20000047290 Research and Technology Organization, Applied Vehicle Technology Panel, Neuilly-sur-Seine, France
NEW METALLIC MATERIALS FOR THE STRUCTURE OF AGING AIRCRAFT *[LES NOUVEAUX MATERIAUX METALLIQUES POUR LES STRUCTURES DES A ERONEFS D ANCIENNE GENERATION]*
New Metallic Materials for the Structure of Aging Aircraft; April 2000; 111p; In English; 19-20 Apr. 1999, Corfu, Greece; See also 20000047291 through 20000047296; Original contains color illustrations; CD-ROM contains full text document in PDF format
Report No.(s): RTO-MP-25; AC/323(AVT)TP/13; ISBN 92-837-1029-0; Copyright Waived; Avail: CASI; A06, Hardcopy; A02, Microfiche; C01, CD-ROM

This workshop dealt with the replacement of Structural component of aging aircraft with components manufactured from materials with specifications of a high qualification, with enhancing various parameters including overall life cycle cost technology (LCC). The following topics were treated: An Overview Aluminium Alloys and Composites Processing, Fatigue and Durability.
Author
Replacing; Aging (Materials); Aluminum Alloys; Fatigue (Materials); Durability

20000053157 Research and Technology Organization, Applied Vehicle Technology Panel, Neuilly-sur-Seine, France
STRUCTURAL ASPECTS OF FLEXIBLE AIRCRAFT CONTROL *[LES ASPECTS STRUCTURAUX DU CONTROLE ACTIF ET FLEXIBLE DES AERONEFS]*
Structural Aspects of Flexible Aircraft Control; May 2000; 302p; In English; Specialists' Meeting of the RTO Applied Vehicle Technology Panel (AVT): Structural Aspects of Flexible Aircraft Control; 18-20 Oct. 1999, Ottawa, Ontario, Canada; See also 20000053158 through 20000053182; CD-ROM contains full text document in PDF format; Original contains color illustrations
Report No.(s): RTO-MP-36; AC/323(AVT)TP/17; ISBN 92-837-0014-7; Copyright Waived; Avail: CASI; A14, Hardcopy; A03, Microfiche; C01, CD-ROM

The specialists' meeting dealt with design issues and more specifically Structural Aspects of Flexible Aircraft Control. Twenty six papers and a keynote address were presented with the following objectives: How the design methods used in the development of military fighter aircraft can be improved, and applied to transport aircraft design applications. There were three sessions covering the following topics: (1) Aeroservoelasticity; (2) Active Control for Flexible Structures I; and (3) Active Control for Flexible Structures II.
Author
Flight Control; Fighter Aircraft; Aircraft Design; Aeroservoelasticity; Transport Aircraft; Flexible Bodies; Control Systems Design

20000053171 NASA Langley Research Center, Hampton, VA USA
RESEARCH ACTIVITIES WITHIN NASA'S MORPHING PROGRAM
McGowan, Anna-Maria R., NASA Langley Research Center, USA; Horta, Lucas G., NASA Langley Research Center, USA; Harrison, Joycelyn S., NASA Langley Research Center, USA; Raney, David L., NASA Langley Research Center, USA; Structural Aspects of Flexible Aircraft Control; May 2000, pp. 13-1 - 13-10; In English; See also 20000053157; Copyright Waived; Avail: CASI; A02, Hardcopy

In the last decade, smart technologies have become important enabling technologies that cut across traditional boundaries in science and engineering. Here smart is defined as the ability to respond to a stimulus in a predictable and reproducible manner. While multiple successes have been achieved in the laboratory, we have yet to see the general applicability of smart technologies to actual aircraft and spacecraft. The NASA Morphing program is an attempt to couple research across a wide range of disciplines to integrate smart technologies into high payoff applications on aircraft and spacecraft. The program bridges research in several technical disciplines and combines the effort into applications that include active aerodynamic control, active aeroelastic control, and vehicle performance improvement. System studies are used to assess the highest-payoff program objectives, and specific research activities are defined to address the technologies required for development of smart aircraft and spacecraft. This paper will discuss the overall goals of NASA's Morphing program, highlight some of the recent research efforts and discuss the multidisciplinary studies that support that research and some of the challenges associated with

bringing the smart technologies to real applications on flight vehicles. Author
NASA Programs; Smart Structures; Active Control; Aeroelasticity; Technology Assessment

20000061419 Research and Technology Organization, Applied Vehicle Technology Panel, Neuilly-sur-Seine, France
AERODYNAMIC DESIGN AND OPTIMISATION OF FLIGHT VEHICLES IN A CONCURRENT MULTI-DISCIPLINARY ENVIRONMENT *[LA CONCEPTION ET L'OPTIMISATION AERODYNAMIQUES DES VEHICULES AERIENS DANS UN ENVIRONNEMENT PLURIDISCIPLINAIRE ET SIMULTANE]*
Aerodynamic Design and Optimisation of Flight Vehicles in a Concurrent Multi-Disciplinary Environment; June 2000; 385p; In English; 18-21 Oct. 1999, Ottawa, Canada; See also 20000061420 through 20000061451; CD-ROM contains full text document in PDF format; Original contains color illustrations
Report No.(s): RTO-MP-35; AC/323(AVT)TP/15; ISBN 92-837-1040-1; Copyright Waived; Avail: CASI; A17, Hardcopy; A04, Microfiche; C01, CD-ROM

The Symposium dealt with Design Issues and more specifically Aerodynamic Design and Optimization of Flight Vehicles in a Concurrent Multi-Disciplinary Environment. Thirty two papers and a Keynote address were presented with the objective to survey the current and future scene given the trend towards a more concurrent and multi-disciplinary approach to aerospace vehicle engineering. There were six sessions covering the following topics: Lessons Learnt/Requirements for the Future Regard to the Role of Aerodynamicists in a Concurrent Multi-Disciplinary Design Process; The Role of Aerodynamics in Concept Phase of a Project Design; MDO and the Aerodynamics Design Process; Methodologies/Tools for Aerodynamic Optimisation; Application of Methodologies/Tools for Aerodynamic Optimisation; Techniques for Rapid Database Generation.
Author
Conferences; Aerodynamics; Design Analysis; Flight Optimization

20000108801 Research and Technology Organization, Systems Concepts and Integration Panel, Neuilly-sur-Seine, France
TECHNOLOGIES FOR FUTURE PRECISION STRIKE MISSILE SYSTEMS *[LES TECNOLOGIES DES FUTURS SYSTEMES DE MISSILES POUR FRAPPE DE PRECISION]*
September 2000; 98p; In English; 23-24 Mar. 2000; 3-4 Apr. 2000; 6-7 Apr. 2000, Atlanta, GA, Turin, Ankara, USA, Italy, Turkey; See also 20000108802 through 20000108809; The CD-ROM contains full text document in PDF format; Original contains color illustrations
Report No.(s): RTO-EN-13; AC/323(SCI)TP/25; ISBN 92-837-1037-1; Copyright Waived; Avail: CASI; A05, Hardcopy; A02, Microfiche; C01, CD-ROM

This lecture series addressed recent advances in the state-of-the-art for precision strike missile systems. Emerging technologies that were addressed in the lecture series included: (1) Missile aeromechanics technologies- Assessments included hypersonic airframes, low cost/high temperature structure, and ramjet propulsion. (2) Guidance & control technologies- An overview of existing guidance and control was given. Assessments included precision navigation using light weight/low GPS/INS and optimal guidance laws. (3) Seeker technologies- Assessments included active and passive imaging infrared and radar seekers. (4) Missile design technologies- Assessments included computer programs and electronic spreadsheets for conceptual design. (5) Missile/aircraft integration technologies- Assessments included high firepower weapon concepts, reduced observables, and insensitive munitions. (6) Simulation/validation technologies- Assessments included hardware-in-the-loop and design validation. (7) Automatic target recognition- Assessments included robust algorithms and hardware/algorithm optimization.
Author
Lectures; Missile Systems; Missile Control; Radar Homing Missiles; Inertial Navigation; Missile Design; Target Recognition; Aerodynamics; Systems Integration

20010002548 Research and Technology Organization, Applied Vehicle Technology Panel, Neuilly-sur-Seine, France
AGING ENGINES, AVIONICS, SUBSYSTEMS AND HELICOPTERS *[MOTEURS, AVIONIQUE, SOUS-SYSTEMES ET HELICOPTERES DE GENERATIONS PRECEDENTES]*
Aging Engines, Avionics, Subsystems and Helicopters; October 2000; 119p; In English; 23-24 Oct. 2000; 26-27 Oct. 2000, Atlantic City, Madrid, USA, Spain; See also 20010002549 through 20010002554; CD-ROM contains full text document in PDF format
Report No.(s): RTO-EN-14; AC/323(AVT)TP/32; RTO-LS-218; ISBN 92-837-1051-7; Copyright Waived; Avail: CASI; A06, Hardcopy; A02, Microfiche; C01, CD-ROM

Aging Aircraft concerns have dramatically escalated in the military community and commercial aviation during the past decade. Some models, which have already been in service for more than 40 years, will need to be retained for another two decades or longer, often serving in roles and in theaters very different from what was envisioned when they were originally designed. Aging Aircraft has several connotations. To name a few: (1) technological obsolescence, (2) the spectre of runaway maintenance costs, and (3) safety. Moreover, spare parts, processes, and tooling may no longer be available, logistic procedures may have changed and suppliers may be out of the business. Budgetary limitations and higher fleet utilization will increase the demand to cope with aging structures and major subsystems like engines and avionics. Specific topics covered by this Lecture Series are: (1) An operator's perspective on aging engines; (2) Modern engine modernization programs; (3) Aging electrical systems and wiring; (4) Aging avionics; (5) Aging helicopter-related issues; (6) Other subsystems; and (7) Safety and service difficulty reporting.
Author
Conferences; Avionics; Costs; Aircraft Maintenance; Aircraft Safety; Aging (Materials); Aircraft Reliability; Damage Assessment

20010009839 Research and Technology Organization, Applied Vehicle Technology Panel, Neuilly-sur-Seine, France
VERIFICATION AND VALIDATION DATA FOR COMPUTATIONAL UNSTEADY AERODYNAMICS *[DONNEES DE VERIFICATION ET DE VALIDATION POUR L'AERODYNAMIQUE INSTATIONNAIRE NUMERIQUE]*
Verification and Validation Data for Computational Unsteady Aerodynamics; October 2000; 567p; In English; See also 20010009840 through 20010009865; CD-ROM contains full text document in PDF format; Original contains color illustrations
Report No.(s): RTO-TR-26; AC/323(AVT)TP/19; ISBN 92-837-1048-7; Copyright Waived; Avail: CASI; A24, Hardcopy; A04, Microfiche; C01, CD-ROM

Computational Unsteady Aerodynamics computer codes are being increasingly used. In order to validate their results they must be tested against valid experimental data. The present report aims at collecting reliable experimental data on unsteady aerodynamics and presenting them in a form which permits use for verification of codes. For ease of handling, the data are also presented in machine readable form (CD-ROM). Data on increasingly complex generic forms were selected and the following categories are covered: flutter, buffet, stability and control, dynamic stall, cavity flows, store separation. Computational solutions are included in order to permit evaluation of codes and analysis of solutions which differ from experimental data.
Author
Unsteady Aerodynamics; Computer Programs; Computation; Data Acquisition

20010028476 Research and Technology Organization, Applied Vehicle Technology Panel, Neuilly-sur-Seine, France
AGING AIRCRAFT FLEETS: STRUCTURAL AND OTHER SUBSYSTEM ASPECTS *[LE VIEILLISSEMENT DES FLOTTES D'AVIONS MILITARIES: ASPECTS STRUCTURES ET AUTRES SOUS-SYSTEMES]*
Aging Aircraft Fleets: Structural and Other Subsystem Aspects; March 2001; 220p; In English; 13-16 Nov. 2000, Sofia, Bulgaria; See also 20010028477 through 20010028491; CD-ROM containing full-text document in PDF format; Original contains color illustrations
Report No.(s): RTO-EN-015; AC/323(AVT-053)TP/33; RTO-LS-218; ISBN 92-837-1056-8; Copyright Waived; Avail: CASI; A10, Hardcopy; A03, Microfiche; C01, CD-ROM

Aging Aircraft concerns have dramatically escalated in the military community and commercial aviation during the past decade. Some models, which have already been in service for more than 40 years, will need to be retained for another two decades or longer, often serving in roles and in theatres very different from what was envisioned when they were originally designed. Aging Aircraft has

several connotations. To name a few: technological obsolescence, the spectre of runaway maintenance costs, and safety. Moreover, spare parts, processes and tooling may no longer be available, logistic procedures may have changed and suppliers may be out of the business. Budgetary limitations and higher fleet utilisation will increase the demand to cope with aging structures and major subsystems like engines and avionics. Specific topics covered by this Lecture Series are: 1) Aircraft Loads; 2) Aging Systems and Sustainment Technology; 3) SNECMA ATAR Engines 1960-2020. Smarter Ideas and Less Money; 4) Repair Options for Airframes; 5) Risk Assessments of Aging Aircraft; 6) Occurrence of Corrosion in Airframes; 7) Human Factors in Aircraft Maintenance; 8) Extension of the Usable Engine Life by Modelling and Monitoring; 9) Loads Monitoring and HUMS; 10) Depot Level Maintenance of U.S. Aircraft Engines in NATO Air Forces. Role of Private Industry and Procedures with U.S. and European Air Forces; 11) Prevention and Control in Corrosion; 12) Safety and Service Difficulty Reporting; 13) Tutorial on Repair Software; 14) Inspection Technologies; 15) Inspection Reliability and Human Factors; 16) Material and Process Technology Transition to Aging Aircraft
Derived from text
Aircraft Maintenance; Aging (Materials); Commercial Aircraft; Aircraft Structures; Airline Operations

20010028480 R-Tec, Rolling Hills Estates, CA USA
REPAIR OPTIONS FOR AIRFRAMES
Ratwani, Mohan M., R-Tec, USA; Aging Aircraft Fleets: Structural and Other Subsystem Aspects; March 2001, pp. 4-1 - 4-19; In English; See also 20010028476; Original contains color illustrations; Copyright Waived; Avail: CASI; A03, Hardcopy

Maintaining the airworthiness of in-service aircraft and at the same time keeping the maintenance cost low is of prime concern to the operators and regulatory authorities. In order to keep maintenance cost low, right decisions need to be made regarding replacing or repairing the in-service damaged components. The choice between replacing or repairing a structural component is governed by a number of factors such as the availability of spares, duration a structural component is expected to be in service, feasibility of repair, repair meeting structural integrity requirements, and inspection requirements for the repair. If it is economical to repair the component then the optimum repair design needs to be selected. This paper discusses structural life enhancement techniques along with the state-of-practice methods of repairing metallic and composite structures. Applications of advanced repair methods such as composite patch repair of cracked metallic structures are discussed. Available computer codes for designing repairs are briefly described.
Derived from text
Airframes; Maintenance; Low Cost; Inspection; Structural Failure; Aircraft Reliability

20010067671 Research and Technology Organization, Applied Vehicle Technology Panel, Neuilly-sur-Seine, France
ACTIVE CONTROL TECHNOLOGY FOR ENHANCED PERFORMANCE OPERATIONAL CAPABILITIES OF MILITARY AIRCRAFT, LAND VEHICLES AND SEA VEHICLES
June 2001; 950p; In English; In French; 8-11 May 2000, Brunswick, Germany; See also 20010067672 through 20010067754; CD-ROM contains full text document in PDF format; Original contains color illustrations
Report No.(s): RTO-MP-051; AC/323(AVT-048)TP/35; ISBN 92-837-0018-X; Copyright Waived; Avail: CASI; C01, CD-ROM; A99, Hardcopy; A10, Microfiche

The Symposium analyzed the potential of active control technology for the performance demands of future vehicles and engines. in particular high maneuverability, lower specific fuel consumption, higher power-to-weight ratios, and lower life-cycle cost. Performance, stability, control, fluid dynamics, structural and engine layout questions were dealt with in five keynotes and 77 papers. The following sessions were held: Boundary Layer Control; Active Flow Control of Nozzle/Jet; Drag and Buffet Control; Noise Control; Vortex Control; Flight Vehicle Active Control; Smart Structures Applications; Active Control Technology For Load Alleviation; Active Elements for Structural Design; Active Materials and Applications; Applications Overview; Compressor Stall/Surge Measurements; Compressor Stall/Surge Control; Combustion Instabilities, Measurements and Predictions; Combustion Instabilities, Control Fundamentals; and Combustion Instabilities, Control Applications. The Symposium was organized by the Applied Vehicle Technology Panel (AVT).
Author
Active Control; Flight Control; Conferences; Boundary Layer Control; Fluid Dynamics; Thrust Vector Control; Buffeting; Combustion Control; Combustion Stability; Aerodynamic Stability

02
AERODYNAMICS

19990032465 NASA Langley Research Center, Hampton, VA USA
AERODYNAMIC PARAMETERS OF HIGH PERFORMANCE AIRCRAFT ESTIMATED FROM WIND TUNNEL AND FLIGHT TEST DATA
Klein, Vladislav, George Washington Univ., USA; Murphy, Patrick C., NASA Langley Research Center, USA; System Identification for Integrated Aircraft Development and Flight Testing; March 1999, pp. 18-1 - 18-20; In English; See also 19990032449; Copyright Waived; Avail: CASI; A03, Hardcopy; A04, Microfiche

A concept of system identification applied to high performance aircraft is introduced followed by a discussion on the identification methodology. Special emphasis is given to model postulation using time invariant and time dependent aerodynamic parameters, model structure determination and parameter estimation using ordinary least squares and mixed estimation methods. At the same time problems of data collinearity detection and its assessment are discussed. These parts of methodology are demonstrated in examples using flight data of the X-29A and X-31A aircraft. In the third example wind tunnel oscillatory data of the F-16XL model are used. A strong dependence of these data on frequency led to the development of models with unsteady aerodynamic terms in the form of indicial functions. The paper is completed by concluding remarks.
Author
System Identification; Unsteady Aerodynamics; Supersonic Aircraft; Fighter Aircraft; Mathematical Models; Aircraft Design; Aerodynamic Characteristics

19990032471 Georgia Inst. of Tech., School of Aerospace Engineering, Atlanta, GA USA
STUDY OF A ROTOR FLAP-INFLOW MODEL INCLUDING WAKE DISTORTION TERMS
Krothapalli, Krishnamohan R., Georgia Inst. of Tech., USA; Prasad, J. V. R., Georgia Inst. of Tech., USA; Peters, David A., Washington Univ., USA; System Identification for Integrated Aircraft Development and Flight Testing; March 1999, pp. 26-1 - 26-10; In English; See also 19990032449; Sponsored in part by Georgia Tech./Washington Univ. Center of Excellence in Rotorcraft Technology; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

For many years, analysts have been puzzled by the fact that the off-axis coupling of a helicopter exhibits the opposite sign in flight tests as compared to simulations. Recently, researchers have shown that the effect may be attributable to the bending of the wake during a pitching maneuver, which introduces a fore-to-aft gradient in induced flow that can reverse the predicted sign of the roll coupling. Other research has shown that this result can also be obtained with momentum and vortex theory. There are many issues still under debate regarding the magnitude of wake distortion and its effectiveness in predicting off-axis dynamics. In the present work, a generalized dynamic wake model is augmented to include wake distortions. This model is then coupled with a flap model for simulation in low speed forward flight. Frequency responses from the simulation are collected with and without wake distortion, and these are compared with wind tunnel test data.
Author
Mathematical Models; Helicopters; Dynamic Models; Data Processing; Simulation; Flapping; Flight Control

19990032475 Scientific and Technical Research Council of Turkey, Defense Industries Research and Development Inst., Ankara, Turkey
AERODYNAMIC DATA IDENTIFICATION USING LINEAR AEROBALLISTIC THEORY
Mahmutyazicioglu, Gokmen, Scientific and Technical Research Council of Turkey, Turkey; Platin, Bulent E., Middle East Technical Univ., Turkey; System Identification for Integrated Aircraft Development and Flight Testing; March 1999, pp. 30-1 - 30-12; In English;

See also 19990032449; Copyright Waived; Avail: CASI; A03, Hardcopy; A04, Microfiche

The history of the linear aeroballistic theory extends to 1920's to Fowler et al. It has been used widely in aeronautical studies for estimating aerodynamic parameters till 1970's when numerical and analytical methods like Chapman-Kirk Kalman filter techniques had been discovered. Today linear aeroballistic theory is still used to get an initial estimate to more complex methods. This is due to its simplicity and ease of application. In this paper, a new formulation, which uses the linear aeroballistic theory to estimate the aerodynamic data, will be presented. Result of the test cases obtained with this formulation will be given.

Author

Parameter Identification; Ballistics; Aerodynamics; Euler Equations Of Motion; Systems Engineering; Estimating; Mathematical Models; Computer Programs

19990040715 Naval Air Warfare Center, Aircraft Div., Patuxent River, MD USA

ACFD APPLICATIONS TO PREDICTING STORE TRAJECTORIES

Cenko, A., Naval Air Warfare Center, USA; Aircraft Weapon System Compatibility and Integration; April 1999, pp. 1-1 - 1-10; In English; See also 19990040714; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

ACFD (Applied Computational Fluid Dynamics) is a tri-service project which has the purpose of verifying Computational Fluid Dynamics (CFD) tools for use by the aircraft-store certification organizations. The project is part of the Test Technology Development and Demonstration (TTD&D) program which is funded by the Office of the Secretary of Defense (OSD) Central Test and Evaluation Investment Program (CTEIP). During the past several years several CFD codes have been evaluated for their ability to predict store loads in aircraft flowfields at transonic speeds. The paper presents the latest results of these evaluations for store external carriage loads and trajectory predictions.

Author

Computational Fluid Dynamics; External Store Separation; Trajectory Optimization; Computerized Simulation; Applications Programs (Computers)

19990040718 British Aerospace Aircraft Group, Military Aircraft and Aerostructures, Preston, UK

A METHOD OF PREDICTING WEAPON BALLISTICS PRIOR TO FLIGHT TRIALS USING EXISTING 6 DOF MODELLING TECHNIQUES

Miles, K., British Aerospace Aircraft Group, UK; Akroyd, G., British Aerospace Aircraft Group, UK; Aircraft Weapon System Compatibility and Integration; April 1999, pp. 6-1 - 6-8; In English; See also 19990040714; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

The process of design and clearance of a modern military aircraft can span decades with the evolution of the design, build, testing and clearance phase leading to the final product. With the drive to shorten these timescales and reduce costs in order to supply the customer with an aircraft as early as possible, any reduction in this cycle time is advantageous. Although the tasks of ballistic modelling and safe separation share a fundamental methodology, in that they both deal with the trajectory of a weapon after it has separated from its parent aircraft, they have until recently been treated as two totally separate tasks. This paper outlines the benefits which can be accrued by using the safe separation models to provide trajectory data ahead of any flight trials. This includes benefits from reductions in both the ground based modelling and flight trials areas, and outlines how this work can improve the accuracy of ballistic data supplied prior to any flight trials work and improve ground impact patterns.

Author

Ballistic Trajectories; External Store Separation; Trajectory Analysis; Mathematical Models; Systems Integration

19990040719 Institute for Aerospace Research, Ottawa, Ontario Canada

PRESSURE MEASUREMENTS ON A F-18 WING USING PSP TECHNIQUE

Tang, F. C., Institute for Aerospace Research, Canada; Lee, B. H. K., Institute for Aerospace Research, Canada; Ellis, F., Institute for Aerospace Research, Canada; Yeung, A., Institute for Aerospace Research, Canada; Lafrance, R., Institute for Aerospace Research, Canada; Aircraft Weapon System Compatibility and Integration; April 1999, pp. 7-1 - 7-14; In English; See also 19990040714; Original contains color illustrations; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

Surface pressure measurements on a 6% scale model of the F-18 have been carried out at the Institute for Aerospace Research 1.5m x 1.5m Trisonic Blowdown Wind Tunnel using the pressure sensitive paint technique. Model configurations included: (1) clean wing; (2) external fuel tanks with empty outboard pylons; and (3) external fuel tanks with two MK-83 and vertical ejection racks on the outboard pylons. In this investigation, pressure data on both the upper and lower wing surfaces as well as over the stores were obtained. The test was performed at a mean chord Reynolds number of 4 x 10(exp 6) and at Mach numbers ranging from 0.6 to 0.95. The angle-of-attack of the model was set at 0 deg and 4 deg nominally with leading and trailing edge flap angles at 0 deg. Detailed quantitative pressure distributions on the model wing surfaces were obtained. Effects of paint surface conditions and temperature variations on the accuracy of the measurements were assessed and are discussed here. The images obtained using the pressure sensitive paint technique also served as a very indicative flow visualization tool.

Author

Pressure Measurement; Pressure Distribution; Body-Wing Configurations; External Tanks; Wing-Fuselage Stores; Aerodynamic Interference; Wing Tanks; Paints; Flow Visualization; Flow Measurement; Wind Tunnel Tests

19990040721 Alenia Aeronautica, Turin, Italy

ALENIA APPROACH TO THE AERODYNAMIC INTEGRATION OF EXTERNAL STORES ON AIRCRAFT

Borsi, M., Alenia Aeronautica, Italy; Barbero, S., Alenia Aeronautica, Italy; Garigliet, E., Alenia Aeronautica, Italy; Pellandino, P., Alenia Aeronautica, Italy; Aircraft Weapon System Compatibility and Integration; April 1999, pp. 9-1 - 9-12; In English; See also 19990040714; Original contains color illustrations; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

The analysis of the store separation trajectories, finalised to the definition of safe release envelopes, is one of the most important tasks to overcome in the aerodynamic design area for the integration of external stores on a combat aircraft. With this paper, Alenia presents the methodologies used in this activity outlining the recent progress obtained with the availability of new advanced tools (Hardware and Software) in the field of CAD and digital image processing.

Author

Aerodynamic Configurations; External Stores; External Store Separation; Systems Integration; Computerized Simulation; Ballistic Trajectories

19990053149 Office National d'Etudes et de Recherches Aerospatiales, Dept. Commande des Systemes et Dynamique de Vol, Paris, France

AERODYNAMIC PERTURBATIONS ENCOUNTERED BY A HELICOPTER LANDING ON A SHIP: EFFECTS ON THE HELICOPTER FLIGHT DYNAMICS

Taghizad, A., Office National d'Etudes et de Recherches Aerospatiales, France; Verbeke, C., Institut de Mecanique des Fluides de Lille, France; Desopper, A., Office National d'Etudes et de Recherches Aerospatiales, France; Fluid Dynamics Problems of Vehicles Operating Near or in the Air-Sea Interface; February 1999, pp. 6-1 - 6-16; In English; See also 19990053143; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

This paper describes a French activity on helicopter ship landing operations simulation improvement. ONERA, under SPAe funding (Service des Programmes Aeronautiques), has developed an aerodynamic disturbance model around the landing deck of a frigate La Fayette, and has tested its effects on helicopter flight dynamics. Wind tunnel tests were carried out in ONERA-IMFL with a 1/50th scaled model of the La Fayette. Three dimensional measurements of the mean wind speed and velocity fluctuations were performed around the landing deck area. The La Fayette aerodynamic wake model includes a mean wake mode (1) to which a turbulence model adds velocity fluctuations measurements. The

model was connected to the Eurocopter Helicopter Overall Simulation Tool (HOST). Simulations of flights above the deck with this model demonstrated important effects of the ship air-wake on the helicopter flight dynamics. This paper describes the test results obtained and the work performed in modelling the La Fayette wake and its influence on the helicopter flight dynamics.
Author
Perturbation; Aerodynamic Characteristics; Landing Simulation; Turbulence Models; Velocity Measurement; Wind Velocity; Ships

19990053161 Academy of Sciences of the Ukraine, Inst. of Hydromechanics, Kiev, Ukraine
HYDRODYNAMICAL CHARACTERISTICS OF AN EKRANOPLANE WING FLYING NEAR THE WAVY SEA SURFACE
Byelinskyy, V. G., Academy of Sciences of the Ukraine, Ukraine; Zinchuk, P. I., Academy of Sciences of the Ukraine, Ukraine; Fluid Dynamics Problems of Vehicles Operating Near or in the Air-Sea Interface; February 1999, pp. 18-1 - 18-12; In English; See also 19990053143; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

Some results of experimental studies conducted at the Institute of Hydromechanics of Ukrainian National Academy of Sciences applicable to the problem of ekranoplane creating are presented in this paper. The aim of these research works was to determine the influence of proximity of the flat and wavy screen upon aerodynamics of the ekranoplane's wing. Experimental installation and procedure of the experiment are described. Instantaneous values of lift, drag and position of the center of pressure for a wing moving above the flat and wavy screen have been defined. It has been determined that influence of the angle of attack, the aspect ratio, the distance to a flat and wavy screen as well as the wave length and wave height of a wavy screen on the wing lift. The measurement results of forces and moments on the wing moving above the oblique waves are given.
Author
Aerodynamics; Hydromechanics; Hydrodynamics; Wings; Ground Effect Machines; Surface Effect Ships; Water Vehicles

19990053162 Marine Technical Univ., Saint Petersburg, Russia
THEORETICAL ANALYSIS OF DYNAMICS OF A WIG VEHICLE IN EXTREME GROUND EFFECT
Rozhdestvensky, K. V., Marine Technical Univ., Russia; Fluid Dynamics Problems of Vehicles Operating Near or in the Air-Sea Interface; February 1999, pp. 19-1 - 19-10; In English; See also 19990053143; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

The paper discusses asymptotic form of the equations of longitudinal motion of ekranoplane in extreme ground effect, i.e. for very small relative ground clearances h. Derivation of 'quartic' and 'quintic' characteristic equations of unsteady perturbed motion is presented. One-dimensional unsteady non-linear theory of a simple flying wing with endplates, moving in close proximity to the ground, is used to determine derivatives of major aerodynamic coefficients with respect to perturbations of height and pitch as well as asymptotic behavior of these derivatives for vanishing h. Asymptotics of perturbed equations of motion is derived for distances of the order of the chord from the moment of perturbation. It is shown that in very close proximity to the ground parameters of stability and motion of the lifting system depend on ratios of design pitch angle and curvature of the lower side of the wing to relative ground clearance h as well as on a 'reduced' density of the vehicle. The analysis also shows that at distances of the order of the chord from the moment of perturbation the vehicle performs corresponding induced motions in height and pitch, its speed remaining almost the same. At distances of the order of chord/h there takes place variation of speed mostly driven by height and pitch perturbations. At distances of the order of chord/h(exp 2) variation of speed of the craft is due to speed perturbation proper.
Author
Unsteady Aerodynamics; Asymptotic Properties; Equations Of Motion; Ground Effect (Aerodynamics); Ground Effect Machines

19990053164 Saint Petersburg Inst. of Aerospace Instrumentation, Saint Petersburg, Russia
AERODYNAMIC SCHEME OF EKRANOPLANE OPTIMIZATION WITH REFERENCE TO NEW AREAS OF APPLICATION
Nebylov, A. V., Saint Petersburg Inst. of Aerospace Instrumentation, Russia; Zhigalko, E. T., Saint Petersburg State Univ., Russia; Fluid Dynamics Problems of Vehicles Operating Near or in the Air-Sea Interface; February 1999, pp. 21-1 - 21-8; In English; See also 19990053143
Contract(s)/Grant(s): RFBR-96-01-00010; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

Opportunities of a choice of the expedient scheme of a large scale ekranoplane (LE) which would ensure the self-stabilization of an angle of attack and the controllability and would improve its properties required, for example, in using LE as a booster for an aerospace plane or as a sea rescue carrier are considered herein. The treated arrangement differs from known ones by utilizing less amount of aircraft elements which are not fully effective in flight of this type.
Author
Flight Optimization; Flight Mechanics; Air Transportation

19990053166 National Aerospace Lab., Amsterdam, Netherlands
AERODYNAMIC ANALYSIS OF A SURFACE PIERCING HYDROFOIL-CONTROLLED WING-IN-GROUND EFFECT SEABUS CONFIGURATION ***PROGRESS REPORT***
vanBeek, C. M., National Aerospace Lab., Netherlands; Oskam, B., National Aerospace Lab., Netherlands; Fantacci, G., Intermarine S.p.A., Italy; Fluid Dynamics Problems of Vehicles Operating Near or in the Air-Sea Interface; February 1999, pp. 23-1 - 23-18; In English; See also 19990053143; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

Preliminary design investigations are presented for a Wing-In-Ground effect craft (SEABUS) in the framework of a European project on technology development for this type of vehicle. The concept of the craft features hydrodynamic control surfaces and a water jet propulsion system. A computational tool is developed and used to investigate the static equilibrium of lift, drag and pitching moment on the complete configuration over the entire speed range by taking the aerodynamic, hydrodynamic and propulsion contributions into account at the same time. Hydrodynamics turns out to be one of the key factors. At cruise speed the total drag of the presently proposed configuration is dominated by the hydrodynamic contributions of the submerged components. Limited effort has been spent on the design of the wing and the high lift system. Aerodynamic analysis of this design shows fair correspondence in terms of lift with the required lift values obtained from the preliminary design method. Ground effect trends on performance are correctly calculated. Optimization of the wing and high lift system has to be pursued.
Author
Piercing; Hydrofoils; Ground Effect (Aerodynamics); Design Analysis; Aircraft Design; Wings; Ground Effect Machines

19990053168 Joint Stock Co. Agency for Technologies and Transport, Nizhny Novgorod, Russia
A VIEW OF THE PRESENT STATE OF RESEARCH IN AERO- AND HYDRODYNAMICS OF EKRANOPLANS
Maskalik, A. I., Joint Stock Co. Agency for Technologies and Transport, Russia; Rozhdestvensky, K. V., Marine Technical Univ., Russia; Sinitsyn, D. N., Joint Stock Co. Agency for Technologies and Transport, Russia; Fluid Dynamics Problems of Vehicles Operating Near or in the Air-Sea Interface; February 1999, pp. 25-1 - 25-12; In English; See also 19990053143; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

Ekranoplans as a novel very high-speed craft is one of the promising transportation alternatives of the next millennium. The paper presents a viewpoint upon present state of research relevant to development of ekranoplans with focus on Russian achievements in this field. Discussed are the problems of aerodynamics, hydrodynamics and dynamics of ekranoplans with particular attention to the matters related to use of power augmentation and peculiarities of static and dynamic stability.
Author
Air Transportation; Hydrodynamics; Static Stability; Dynamic Stability; Ground Effect Machines

19990053173 Fischer-Flugmechanik, Willich, Germany
THE HOVERWING TECHNOLOGY: BRIDGE BETWEEN WIG AND ACV
Fischer, Hanno, Fischer-Flugmechanik, Germany; Matjasic, Klaus, Fischer-Flugmechanik, Germany; Fluid Dynamics Problems of Ve-

hicles Operating Near or in the Air-Sea Interface; February 1999, pp. 30-1 - 30-8; In English; See also 19990053143; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

Wingships (WIG, Wing in Ground) utilize water as runways to reach their lift-off speed, which is determined by the wing loading. High Wing loadings are desirable for high cruising speeds with inherent height and longitudinal stability. To build up the necessary dynamic air pressure under the wing, they need roughly 3 times more power to overcome the hydrodynamic hump-drag compared to the drag during ground effect flight. So it is necessary to develop suitable devices as lift-off-aids in order to reduce the recommended power. With support of the German Ministry for R and D (BMB+F) Fischer-Flugmechanik (FF) has developed the 'Hoverwing - Technology' in order to further reduce the necessary lift-off power. The principle of this technology, for which FF has patent rights, is the building up of static air pressure between the catamaran float. After lift-off the dynamic pressure will replace the static pressure and the craft operates as a WIG with high lift to drag ratios. FF is developing the 'Hoverwing 80', with the target to transport 80 passengers at 100 kts. Some tests results with a scaled down two Seater will be demonstrated by video extracts.

Author

Ground Effect (Aerodynamics); Aircraft Design; Ground Effect Machines

20000011864 Research and Technology Organization, Applied Vehicle Technology Panel, Neuilly-sur-Seine, France

A FEASIBILITY STUDY OF COLLABORATIVE MULTI-FACILITY WINDTUNNEL TESTING FOR CFD VALIDATION *[ETUDE DE FAISABILITE D'ESSAIS EN SOUFFLERIE MULTISITES MENES EN COOPERATION EN VUE DE LA VALIDATION DES CALCULS DE L'AERODYNAMIQUE NUMERIQUE - CFD]*

December 1999; 40p; In English

Report No.(s): RTO-TR-27; AC/323(AVT)TP/21; ISBN 92-837-1023-1; Copyright Waived; Avail: CASI; A03, Hardcopy; A01, Microfiche

Between 1997 and 1999, a Working Group on the feasibility of collaborative, multi-facility windtunnel testing for the validation of Computational Fluid Dynamics Codes (CFD) has established the following results: Windtunnel tests are the main source of CFD validation but all have specific bias errors. Testing of the same model in several facilities can better establish the level of uncertainty in windtunnel tests and hence help assess possible differences between CFD and windtunnel tests. The working group, after an initial inquiry, established the need for CFD validation for fighter aircraft, transport type aircraft, missiles and helicopters. Effort and cost can be controlled efficiently and would permit the improvement of CFD Codes for considerable cost saving in future developments.

Author

Feasibility; Feasibility Analysis; Cost Analysis; Cost Effectiveness; Computational Fluid Dynamics; Wind Tunnel Tests; Wind Tunnels

20000037896 Naval Air Systems Command, Patuxent , MD USA

TACTICAL PAYLOADS FOR UAVS

Carruso, Amy Houle, Naval Air Systems Command, USA; Development and Operation of UAVs for Military and Civil Applications; April 2000, pp. 9-1 - 9-5; In English; See also 20000037887; Copyright Waived; Avail: CASI; A01, Hardcopy

The Tactical Systems Program Office of the Program Executive Officer, Cruise Missiles and Unmanned Aerial Vehicles PEO(CU) is developing and refining Payload Concepts of Operation (CONOPS) based on demonstrated capabilities, new technology, and emerging operator needs. The Tactical Systems Program Office continues to expand technical and operational capabilities for increased Unmanned Aerial Vehicle (UAV) applications. To support future military operations, the Tactical Systems Program Office foresees UAVs as a complement to manned and space based systems. Traditionally, UAV Payload operations focused on the ElectroOptical/InfraRed (EO/IR) reconnaissance role. While still the highest priority requirement, new technologies have expanded potential payload applications. Aware of the importance of newly maturing technologies, the Tactical Systems Program Office continuously monitors technologies sponsored by the Government and industry to determine their direct application to UAV airborne platforms and ground stations.

Author

Pilotless Aircraft; Payloads; Aerial Reconnaissance; Infrared Imagery; Infrared Radiation

20000061420 British Aerospace Public Ltd. Co., Military Aircraft and Aerostructures, Warton, UK

EUROFIGHTER: AERODYNAMICS WITHIN A MULTI-DISCIPLINARY DESIGN ENVIRONMENT

McKay, Keith, British Aerospace Public Ltd. Co., UK; Aerodynamic Design and Optimisation of Flight Vehicles in a Concurrent Multi-Disciplinary Environment; June 2000, pp. 1-1 - 1-10; In English; See also 20000061419; Copyright Waived; Avail: CASI; A02, Hardcopy

The art and science of aerodynamics have been developing continually to meet the changing needs of aircraft of all types, in many cases, combat aircraft design drives this development farther and faster in the search for improved combat effectiveness. One result has been that an ever broadening of the individual but heavily integrated aspects of aerodynamics into a set of interdependent, diverse fields, covering fluid dynamics, structural dynamics, solid body mechanics, ballistics, acoustics and more recently electromagnetics. Together, these individual disciplines are combined together into a term sometimes referred to as aerodynamic technology, as described in a recent Royal Aeronautical Society edition. This paper will examine the requirements placed upon these disciplines in the light of the multi-disciplinary design optimisation process that took place on the Eurofighter project, specifically highlighting the roles of the aerodynamic technologies within that process and the lessons learned from their application in this environment. The paper will also provide some recommendations for improvements in the design capabilities based upon the experience gained and lessons learned from the design of the Eurofighter Weapon System.

Author

Aerodynamics; Aircraft Design; Dynamic Structural Analysis

20000061432 British Aerospace Public Ltd. Co., Military Aircraft and Aerostructures, Warton, UK

AN MDO APPLICATION FOR A WEAPON RELEASED FROM AN INTERNAL BAY

Moretti, G., British Aerospace Public Ltd. Co., UK; Spicer, D., British Aerospace Public Ltd. Co., UK; Sharples, N., British Aerospace Public Ltd. Co., UK; Aerodynamic Design and Optimisation of Flight Vehicles in a Concurrent Multi-Disciplinary Environment; June 2000, pp. 14-1 - 14-12; In English; See also 20000061419; Original contains color illustrations; Copyright Waived; Avail: CASI; A03, Hardcopy

Multi Disciplinary Optimisation (MDO) process has always been identified as an essential tool for the development of an aircraft design. Recent engineering emphasis has been on improving the depth of optimisation within a reduced overall time frame, a goal which depends on the level of automation available and the capability and skill of each discipline. The figure below shows an overview of the general design cycle in the military aircraft manufacturer's world. The large time spans involved in the full process should be appreciated: it may take between ten and twenty years to bring a new project to fruition.

Author

Optimization; Aircraft Design; Procedures

20000061433 Pisa Univ., Dipartimento di Ingegneria Aerospaziale, Italy

AERODYNAMICS FOR MDO OF AN INNOVATIVE CONFIGURATION

Bernardini, G., Pisa Univ., Italy; Frediana, A., Pisa Univ., Italy; Morino, L., Rome Univ., Italy; Aerodynamic Design and Optimisation of Flight Vehicles in a Concurrent Multi-Disciplinary Environment; June 2000, pp. 16-1 - 16-11; In English; See also 20000061419; Copyright Waived; Avail: CASI; A03, Hardcopy

A numerical methodology for the evaluation of aero-dynamic loads acting on a complex lifting configuration is presented. The work is limited to the case of attached high-Reynolds number flows. A viscous/potential interaction technique is utilized to take into account the effects of the viscosity. For the potential-flow analysis, a boundary element formulation is used; for simplicity, only incompressible flows are examined. The theoretical basis of the present methodology is briefly described. Comparisons with available, numerical and experimental results are included.

Author

Aerodynamic Loads; Numerical Analysis; Evaluation; Loads (Forces)

20000061443 Synaps Ingenieur-Gesellschaft m.b.H., Bremen, Germany
A CONCEPTUAL DESIGN METHODOLOGY TO PREDICT THE WAVE DRAG OF A TRANSONIC WING
Kribler, T., Synaps Ingenieur-Gesellschaft m.b.H., Germany; Aerodynamic Design and Optimisation of Flight Vehicles in a Concurrent Multi-Disciplinary Environment; June 2000, pp. 27-1 - 27-8; In English; See also 20000061419; Copyright Waived; Avail: CASI; A02, Hardcopy

A conceptual design methodology to predict the wave drag of a transonic wing for use within multidisciplinary aircraft design was developed. To achieve this, a database of cross section designs optimized with respect to total drag was set up varying the design parameters Ma, t/c, C(sub L) and Re. Mathematical formulations for the aerodynamic cross section characteristics total drag, viscous drag and the local shock location were derived from the database as functions of the design parameters. The cross section wave drag was then derived using these formulations. A locally infinite swept wing is assumed and simple sweep theory using the shock sweep angle is used to transform the wave drag. The wave drag of a 3-D wing is predicted summing locally infinite swept wing sections in spanwise direction. The achieved drag prediction is accurate enough for use within conceptual aircraft design and predicts well the trends in wave drag development as a function of the design parameters Ma, t/c, C(sub L), Re and the wing planform.
Author
Aircraft Design; Design Analysis; Wave Drag; Transonic Flow; Wing Planforms

20000061444 Florida Univ., Dept. of Aerospace Engineering, Mechanics and Engineering Science, Gainesville, FL USA
AIRFOIL AND WING PLANFORM OPTIMIZATION FOR MICRO AIR VEHICLES
Sloan, J. G., Florida Univ., USA; Shyy, W., Florida Univ., USA; Haftka, R. T., Florida Univ., USA; Aerodynamic Design and Optimisation of Flight Vehicles in a Concurrent Multi-Disciplinary Environment; June 2000, pp. 28-1 - 28-14; In English; See also 20000061419; Copyright Waived; Avail: CASI; A03, Hardcopy

Low Reynolds number flight for micro air vehicles (microAVs) suffers from laminar separation resulting in reduced lift and increased drag. The objective of the present work is to use the response surface methodology (RSM) to identify correlations between the airfoil and the wing planform to facilitate a two-level optimization procedure in which an optimized airfoil and wing planform are reached simultaneously. Several approaches have been considered in this work. A constant cross-section wing is modeled with maximum camber, y(sub c), maximum thickness, y(sub t) and aspect ratio,AR, as design variables at two different Reynolds numbers of 8.0 x 10(exp 4) and 2.0 x 10(exp 5). This is done to determine how the optimal airfoil may change for different aspect ratios and Reynolds numbers. A variable cross-section wing defined by root camber and angle-of-attack and tip camber and angle-of-attack is modeled in order to determine how the optimal airfoil may change from the root to the tip of the wing. Due to the size restrictions on microAVs, a fixed-span approach is used to model an aircraft subject to the constraints of steady flight with the aspect ratio and camber as design variables. This third approach balances trade-offs between wing area, aspect ratio, and Reynolds number in determining the overall flight efficiency. Optimal airfoils exhibit characteristics which change little with wing aspect ratio or location on the wing planform. There appears to be a trend of increasing optimal camber with decreasing Reynolds number. While the optimal design seems to favor airfoils with minimum thickness and relatively modest camber of about 4 to 5% of the chord, a higher camber may be a better choice if higher lift coefficient at minimum power is used as a design goal. Measurements of both the global and the local response surface prediction accuracy combined with design space refinement help to assess the reliability of the response surface approximations and optimal design predictions.
Author
Airfoils; Wing Planforms; Optimization; Camber; Design Analysis; Low Reynolds Number

20000061446 Aerospatiale, Matra Missiles, Chatillon, France
MULTI-FLIGHT CONDITION OPTIMIZATION OF THREE DIMENSIONAL SUPERSONIC INLETS
Carrier, Gerald, Aerospatiale, France; Bourdeau, Christophe, Aerospatiale, France; Knight, Doyle, Rutgers Univ., USA; Kergaravat, Yan, Aerospatiale, France; Montazel, Xavier, Aerospatiale, France; Aerodynamic Design and Optimisation of Flight Vehicles in a Concurrent Multi-Disciplinary Environment; June 2000, pp. 30-1 - 30-10; In English; See also 20000061419
Contract(s)/Grant(s): DDM980001N; Copyright Waived; Avail: CASI; A02, Hardcopy

This paper presents an innovative methodology to address the three-dimensional supersonic inlet design problem. An efficient and robust process allows to optimize the aerodynamic performance of inlets for multiple flight conditions. This optimization process links together an optimizer with a fast and accurate simulation tool into an automated optimization loop. The implementation of this new design technique and its applications to two different test cases are presented, namely, the optimization for a single cruise condition, and the optimization for a mission comprised of acceleration, cruise and maneuver phases. The mission-optimized inlet achieves better overall performance than the cruise-optimized inlet.
Author
Flight Conditions; Supersonic Inlets; Procedures; Three Dimensional Models

20000108802 Georgia Inst. of Tech., Aerospace Systems Design Lab., Atlanta, GA USA
TECHNOLOGIES FOR FUTURE PRECISION STRIKE MISSILE SYSTEMS: MISSILE AEROMECHANICS TECHNOLOGY
Fleeman, Eugene L., Georgia Inst. of Tech., USA; Technologies for Future Precision Strike Missile Systems; September 2000, pp. 2-1 - 2-10; In English; See also 20000108801; Original contains color illustrations; Copyright Waived; Avail: CASI; A02, Hardcopy

This paper provides an assessment of the state-of-the-art of new aeromechanics technologies for future precision strike missile systems. The aeromechanics technologies are grouped into specific discussion areas of aerodynamics, propulsion, and airframe materials technologies. Technologies that are addressed in this paper are: Missile aerodynamics technologies- Assessments include aerodynamic configuration shaping, lattice tail control, split canard control, forward swept surfaces, bank-to-turn maneuvering, and flight trajectory shaping; Missile propulsion technologies- Assessments include supersonic air breathing propulsion, high temperature combustors, low drag ramjet inlets, ramjet inlet/airframe integration, high density fuels, and rocket motor thrust magnitude control; and Missile airframe materials technologies- Assessments include hypersonic structure materials, composite structure materials, hypersonic insulation materials, multi-spectral domes, and reduced parts count structure.
Author
Missile Systems; Aerodynamics; Propulsion; Missile Design; Airframes; Missile Components; Missile Configurations; Missile Control; Radar Homing Missiles

20010009842 National Aerospace Lab., Amsterdam, Netherlands
DATA FROM AGARD REPORT 702: NACA 64A006 OSCILLATING FLAP; NACA 012 OSCILLATORY AND TRANSIENT PITCHING; NLR 7301 SUPERCRITICAL AIRFOIL OSCILLATORY PITCHING AND OSCILLATING FLAP; AND ZKP WING, OSCILLATING AILERON
Landon, R. H., Aircraft Research Association Ltd., UK; Verification and Validation Data for Computational Unsteady Aerodynamics; October 2000, pp. 29-96; In English; See also 20010009839; Copyright Waived; Avail: CASI; A04, Hardcopy

In the late seventies a need was perceived for standard comparison cases and experimental data to aid the comparison and validation of the theoretical methods then emerging for unsteady aerodynamics. A Working Group of the AGARD Structures and Materials panel chose a set of 2-D and 3-D configurations and for each configuration defined a set of test cases, including a priority subset, to be used for comparisons. These test cases were fully identified. The chosen configurations were known as the AGARD Aeroelastic Configurations and the chosen cases were denoted as Computational Test (CT) cases. Some of the CT cases were entirely theoretical while others were also the subject of unsteady measurements. The next step undertaken to aid the methods development was to produce an experimental data compendium (AGARD Report 702, which was conceived with the idea of bringing together the experimental data most important for the comparisons. The report was followed by an Addendum, which introduced two additional 3-D

experiments. These reports established an admirable common base for providing experimental data and their value has been demonstrated by the repeated use of the test cases for the entire period since publication. The report has served as a model for the present new compendium of experimental data. It was decided that some of the data cases in the original Report 702 should be reproduced in this document in order to provide more complete coverage in this report with the additional bonus of making available the original data in electronic form to facilitate its continued use to validate calculations.
Author
Data Acquisition; Flapping; Oscillations; Proving

20010009856 Institute for Aerospace Research, Ottawa, Ontario Canada
SELECTED DATA SET FROM STATIC AND ROLLING EXPERIMENTS ON A 65 DEG DELTA WING AT HIGH INCIDENCE
Huang, X. Z., Institute for Aerospace Research, Canada; Lui, T. C., Institute for Aerospace Research, Canada; Hanff, E. S., Institute for Aerospace Research, Canada; Verification and Validation Data for Computational Unsteady Aerodynamics; October 2000, pp. 383-405; In English; See also 20010009839; Copyright Waived; Avail: CASI; A03, Hardcopy

This data set is selected from an extensive set of experimental results obtained for configurations with a 65 deg delta wing under static as well as large-amplitude high-rate rolling or pitching conditions at high incidence. The experiments were performed under a joint research program on 'Non-Linear Aerodynamics under Dynamic Maneuvers' by the National Research Council of Canada (NRC (IAR)), the U.S. Air Force (USAF (AFOSR, AFRL)) and the Canadian Dept. for National Defence (DND). NASA Ames informally participated in the program through its substantial CFD work on specific test conditions. The experimental results provide both detail pressure measurements and a wide range of flow conditions covering from simple attached flow, through fully developed vortex and vortex burst flow, up to fully-stalled flow at very high incidence. Since this data set includes different levels of physical difficulty, the computational researchers working in unsteady aerodynamics can use it as a staircase approach to the problem of validating their corresponding code. Four schematic and representative configurations# were selected in the experiments: 1) 65 deg delta wing; 2) 80/65 deg double delta wing; 3) 65 deg delta wing with a single vertical tail and a circular ogive forebody, 4) 65 deg delta wing with a single vertical tail and an elliptical cross section forebody whose major axis could be installed either horizontally or vertically. Experiments with the above models include the following test parameters: 1) motion variables (rolling or pitching), 2) modes (static or dynamic), 3) motion waveform (harmonic, ramp-and-hold, free-to-roll and 'forced' free-to-roll), 4) observed variables (flow visualization, motion history, steady and unsteady loads and surface pressure), 5) wind tunnel interference assessment (by repeat tests in different wind tunnels), 6) support interference assessment (by repeat tests with different supports). The words of 'forced' free-to-roll refer to the experiments performed in the forced mode with the same motion as observed under free-to-roll condition so that the unsteady surface pressures prevailing during free-to-roll motions could be obtained. The installation and support arrangements in the two wind tunnels are shown. The models, rolling rig and pitching rig were designed by IAR. Experiments were conducted both at the IAR and AFRL wind tunnels (LSWT and SARL respectively) summarizes the test matrix. A complete list of tests with corresponding conditions can be found. The comparisons of repeat tests conducted in different wind tunnels and supports confirm that both wind-tunnel as well as support interference are negligible. Due to large number of tests conducted, this data set contains only ten typical cases for the 65 deg delta wing, are shown. These cases were selected to cover typical sets of tests such as static tests and harmonic, ramp- and-hold, free-to-roll and 'forced' free-to-roll dynamic tests. Seven spanwise-distributed surface pressure transducers on the up surface of the port wing were used to measure the instantaneous surface pressure during the motion. Three typical sting angles: sigma = 15 deg, 30 deg and 35 deg were selected as being representative of different leading- edge vortex behavior. In the absence of sideslip, at sigma=15 deg the leading-edge vortex is intact over the full length of the model, leading to small non-linearities and time dependence; at gigma=30 deg vortex breakdown occurs over the aft part of the wing leading to severe non-linearities and time dependence; and finally, at gigma=35 deg vortex breakdown is present over the forward portion of the wing resulting in different characteristics.
Author
Data Acquisition; Delta Wings; Dynamic Tests; Computational Fluid Dynamics; Stabilizers (Fluid Dynamics); Unsteady Aerodynamics

20010009858 Duits-Nederlandse Windtunnel, Brunswick, Germany
OSCILLATING 65 DEG DELTA WING, EXPERIMENTAL
Lieser, Thomas, Duits-Nederlandse Windtunnel, Germany; Verification and Validation Data for Computational Unsteady Aerodynamics; October 2000, pp. 415-430; In English; See also 20010009839; Copyright Waived; Avail: CASI; A03, Hardcopy

This data set contains force and pressure data resulting from static and dynamic measurements on a sharp-edged cropped delta wing with a leading edge sweep of 65# oscillating in different modes. Motivation for the experiment were the provision of experimental data for validation of unsteady computational codes and understanding of the flow past an oscillating delta wing. The model geometry is identical to a geometry used in the Vortex Flow Experiment for Computer Code Validation (VFE), a multinational cooperation which provided experimental data of delta wing configurations in the mid eighties. The geometry of the wing is also used for steady and unsteady calculations within the Western European Armament Group (WEAG, formerly IEPG) TA - 15. The experiments have been performed in 1994 (force measurements) and 1995 (pressure measurements). They were performed in the German-Dutch wind tunnel DNW-NWB at low speeds, the model undergoing pitching, yawing or rolling motions about wind-fixed axes. The choice of the mean angles of attack was closely related to the expected flow types: alpha(sub 0) = 0 deg: In this case the vortex formation will alternate between the upper and the lower surface of the configuration during the pitching motion. Alpha(sub 0) = 9 deg: Vortices will be present over the upper surface of the configuration and no vortex breakdown will occur during the whole cycle of the pitching motion. Alpha(sub 0) = 15 deg and alpha(sub 0) = 21 deg: These conditions are related to mixed cases without vortex breakdown over the configuration at low angles of attack and with vortex breakdown at high angles of attack during the cycle of motion. Alpha(sub 0) = 27 deg: Vortices with vortex breakdown are expected to occur over the upper surface of the configuration and this type of flow will be present during the whole cycle of the pitching motion. Alpha(sub 0) = 42 deg: During the cycle of the pitching motion the flow is expected to switch between a vortex-type flow with vortex breakdown and a dead-water-type flow. Alpha(sub 0) = 48 deg: In this case a dead-water-type flow is expected during the whole cycle of motion. The mean angles of attack at which no vortex breakdown occurs during the complete cycle of motion are simpler to treat numerically. Therefore the pitching oscillations about alpha(sub 0) = 9 deg was the first case to be included in a WEAG TA-15 common exercise. The other case included in that common exercise is the pitching oscillation about alpha(sub 0) = 21 deg, the reduced frequency being 0.56 for all mean angles of attack. Results from unsteady Euler and Navier-Stokes calculations of pitching oscillation about alpha(sub 0) = 9 deg with an amplitude of Delta(alpha)(sub 0) = 3 deg by W.
Author
Aerodynamic Configurations; Computational Fluid Dynamics; Delta Wings; Vortex Breakdown; Pressure Measurement; Oscillating Flow

20010009859 DaimlerChrysler Aerospace A.G., Military Aircraft, Munich, Germany
OSCILLATING 65 DEG DELTA WING, NUMERICAL
Fritz, Willy, DaimlerChrysler Aerospace A.G., Germany; Verification and Validation Data for Computational Unsteady Aerodynamics; October 2000, pp. 431-435; In English; See also 20010009839; Copyright Waived; Avail: CASI; A02, Hardcopy

This data set consists of steady and unsteady numerical solutions of a sharp-edged cropped delta wing with a leading edge sweep of 65 deg undergoing a pitching oscillation. The geometry of the wing corresponds with the geometry of the wind tunnel model described in the previous data set, the difference being the absence of the fuselage in the numerical model. The presence of the fuselage on the upper surface flow is believed to have an effect at small angles of attack only on the forward region of the wing and to have an effect on the location of vortex breakdown at large angles of attack. The pitching oscillation has an amplitude of 3 deg, the mean angle of attack is 9 deg. The position of the oscillation axis and the

reduced frequency have been set to match one of the reduced frequencies of the aforementioned experiment, while the Mach number has been increased from the experiment's Mach number 0.12 to 0.4 to reduce computational time. The data set includes field solutions from Euler as well as from Reynolds averaged Navier-Stokes (RANS) calculations for four equidistant instants within one oscillation cycle and for the corresponding static solution (alpha = 9 deg). Comparison of the Euler and RANS solutions shows the well known differences in strength and spanwise location of the primary vortex-induced suction peak due to the absence of a secondary vortex in the Euler solution. The agreement with the experimental results is very good.
Author
Euler Equations Of Motion; Navier-Stokes Equation; Delta Wings; Mathematical Models; Numerical Analysis; Oscillating Flow; Vortex Breakdown

20010009862 British Aerospace Defence Ltd., Military Aircraft and Aerostructures, Brough, UK
M219 CAVITY CASE
Henshaw, M. J. de, British Aerospace Defence Ltd., UK; Verification and Validation Data for Computational Unsteady Aerodynamics; October 2000, pp. 453-472; In English; See also 20010009839; Copyright Waived; Avail: CASI; A02, Hardcopy

The data contained in this set consists of pressure time histories measured on the ceiling of an empty rectangular cavity, and were measured as part of a joint BAe./DERA programme at the ARA wind tunnel at Bedford during November 1991. The overall programme consisted of several configurations, with bodies positioned at various proximities to the cavity, but the data presented here only considers the empty cavity, configured for both shallow and deep cases. Data were measured using Kulite transducers along the centreline of the rig, (which did not coincide with the centreline of the cavity itself), and, in an alternative configuration, on the centreline of the cavity. Measurements taken off the cavity centreline, but not included here, indicated that 3D effects were not significant.
Author
Cavities; Data Acquisition; Pressure Measurement

20010009863 Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Inst. of Design Aerodynamics, Brunswick, Germany
DLR CAVITY PRESSURE OSCILLATIONS, EXPERIMENTAL
Delfs, Jan, Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; Verification and Validation Data for Computational Unsteady Aerodynamics; October 2000, pp. 481-487; In English; See also 20010009839; Copyright Waived; Avail: CASI; A02, Hardcopy

Windtunnel tests were carried out with the aim of establishing a measured unsteady surface pressure data set in and around a box-shaped shallow cavity, subject to tangential flow in the transonic Mach number range. Apart from the baseline case, for which systematic Mach number and Reynolds number variations were completed, the main purpose of the tests was to investigate the effect of certain upstream mounted passive flow control devices on the cavity oscillations for selected Mach numbers. This chapter contains the description of two baseline case data sets of unsteady surface pressures for freestream Mach number M_ = 0.8 and M_ = 1.33 respectively, made available to RTO. The main purpose of the experiment was to test techniques for the passive control of pressure oscillations occurring in and near cavities exposed to tangential transonic flows. Moreover, the phase relation among the different cavity modes were investigated since the design of devices (passive and especially active) for control, critically depends on the knowledge and an understanding of the underlying physical mechanisms responsible for the resonances driving the phenomenon. Despite its long term investigation and the corresponding vast literature on cavity oscillations, reliable prediction schemes exist only for the frequencies of the oscillation modes. An insight into the phase relations among the modes however is necessary e.g. in order to lay out the characteristics of a controller for a closed loop active control of the oscillations. Therefore the present tests were also performed to reveal the spatio- temporal phase relation among the modes in the cavity. The tests were done in the DLR wind tunnel TWG (Transonic Windtunnel Gottingen) in November 1997. The closed system tunnel has a test section area of 1m x 1m and is operated continuously. The cavity oscillation model is mounted on a cropped sting and consists basically of a flat plate, containing the cutout for the box-shaped cavity of length L = 0.202 m, width W = 0.03 m and depth D = 0.05 m, which in turn is hosted in the fuselage carrying the model. Unsteady surface pressures were measured using flush mounted Kulite pressure transducers as specified. The static pressures at three positions on the plate surface upstream of the cavity were measured in order to determine the actual Mach number of the flow above the cavity. A geometrical angle of attack of alpha = 1 deg was set in order to assure non-separating flow at the sharp leading edge of the plate. The cavity's bottom surface was made of an aluminium plate, which could be translated along the x-direction (streamwise) with the help of a remote-controlled electric motor. Six equally (in chi) spaced Kulite sensors were flush mounted into the moveable plate. It was possible to take measurements at arbitrary chi-positions of the cavity's bottom surface by moving the plate (and thus the six sensors) to the desired setting. For each flow parameter this was done for 12 positions of the plate. From one position to the next, the plate was advanced upstream in steps of 3 mm. For each of these settings the time histories of all Kulite sensors (including all non-moveable sensors) were recorded simultaneously along with the static flow data. Thus for each of the 12 positions the phase relation between all sensors can be evaluated.
Author
Experimentation; Active Control; Transonic Speed; Remote Control; Pressure Oscillations; Wind Tunnel Tests; Cavity Flow

20010009864 Glasgow Univ., UK
DYNAMIC STALL DATA FOR 2-D AND 3-D TEST CASES
Galbraith, R. A. McD, Glasgow Univ., UK; Coton, F. N., Glasgow Univ., UK; Green, R. B., Glasgow Univ., UK; Vezza, M., Glasgow Univ., UK; Verification and Validation Data for Computational Unsteady Aerodynamics; October 2000, pp. 489-533; In English; See also 20010009839; Sponsored in part by the EPSRC; Copyright Waived; Avail: CASI; A03, Hardcopy

Although substantial work has been carried out and much understanding gained of the phenomena associated with dynamic stall, our description and understanding of it is incomplete. Even if we consider the nominally two-dimensional flow associated with most experiments, some significant anomalies have yet to be explained. Fully three-dimensional experiments are few and, as might have been expected, raise more questions than have been answered. The purpose of the selected cases herein is to provide the computational fluid dynamic specialists with a variety of test data to assess the output of their codes. The experimentalists may then obtain additional information from the CFD specialists so that together the knowledge and understanding of dynamic stall and the associated anomalies may be enhanced. As described by Young, the nominally two-dimensional case is considered to be characterized by a dynamic overshoot of the aerodynamic coefficients followed by stall onset and the roll-up of the shed vorticity into a coherent vortex that convects over the upper surface of the aerofoil and then off into the mainstream. It is the convection speed of the main vortex (dynamic stall vortex) in which a distinctive anomaly has been identified by Green et al. It was observed that certain data indicated an independence of the convection speed from the motion of the model, whilst others did not. Of all the influencing factors that could have contributed to that clear difference of result, such as aerofoil shape, aspect ratio, surface finish, data reduction software and Mach number, all but the Mach number had no effect on the observed trends. Green and Galbraith concluded that the most likely contender causing the two very different results would be the difference in the Mach number between the experimental set-ups. Albeit the data sets contained in section 1 are for low Mach numbers (M = 0.12) they do cover a wide range of reduced pitch rate. If CFD results reproduce the constancy of 'stall vortex' convection speed observed, then it would be helpful to recalculate for a few higher Mach numbers; say, 0.2, 0.4 and 0.7. Although the Glasgow data (covering 14 different models) indicated an independence of convection speed with regard to the reduced pitch rate and the reduced frequency, there was a variation between different models. It was observed, however, that the speed did appear to be dependent on the shape of the aerofoil and the method of transition. It appeared that, if a transition strip was placed at the leading edge (consisting of filtered grit) then the convection speed was reduced and, similarly, the scatter. Suitably 'tripped' data are contained in section 2. Section 2 presents data from two NACA 00 15 aerofoils of different aspect ratio. It is hoped that the spread of test cases can be used to assess the quality of prediction of low-speed dynamic stall. The data are for motions of 'ramp-up', 'ramp-down' and oscillatory pitch. Both the ramp-up and ramp-down are important

because they isolate the stalling mechanisms from the re- attachment process. As such, the mix, where the aerofoil is simultaneously attempting to stall and 're-attach', during some oscillatory modes, is absent. In addition, the ramp-downs will provide a most interesting case because the data clearly show that, at the high pitch rates, one can achieve negative lift at high incidence. Figure 2 shows the effect of pitch rate upon the normal force during ramp-down tests of the Sikorsky SSC-A09 aerofoil. Although this was not the most severe case, it does indicate that it has negative lift at incidence as high as 8 degrees; other, uncambered aerofoils produced negative lift at incidences as high as 10 degrees. Both the NACA 0015 aerofoils are for a nominally two-dimensional test set-up, although, at least for the steady case, the flows are likely to be highly three-dimensional in the stall condition. Nonetheless, the data are very comparable and show very similar trends, especially in the ramp-down motion. The only significant difference between the high aspect and the low aspect ratio models is, of course, the Reynolds number. This manifests itself in the ramp-down mode only in the latter stages of re-attachment. This is a consequence of the Reynolds number effects on the boundary layer. The section 3 data from a finite wing with a NACA 0015 section is presented and provides a very severe test case for any current CFD code.
Author
Data Acquisition; Two Dimensional Flow; Three Dimensional Flow; Aerodynamic Stalling; Airfoils; Uncambered Wings; Vortices

20010009865 Sverdrup Technology, Inc., Arnold Engineering Development Center, Arnold AFS, TN USA
GENERIC WING, PYLON, AND MOVING FINNED STORE
Fox, John H., Sverdrup Technology, Inc., USA; Verification and Validation Data for Computational Unsteady Aerodynamics; October 2000, pp. 535-554; In English; See also 20010009839; Original contains color illustrations; Copyright Waived; Avail: CASI; A03, Hardcopy

A Computational Fluid Dynamics (CFD) Program of the U. S. Air Force Research Laboratory (AFRL), formerly (AFATL), funded and supported this wind tunnel test. The data support the ongoing validation efforts for CFD codes. A review at AEDC, completed June 12, 1996, determined the data were unrestricted. The test met the objectives of providing pressure data horn geometrically simple wing and store shapes under mutual interference conditions with the store both at its carriage position and at selected points along a realistic store separation trajectory. AFRL chose AEDC's 4-Foot Transonic Aerodynamic Wind Tunnel (4T) for the test. AEDC's Captive Trajectory Support (CTS) system, a moving store-support mechanism simulated the motion of the store. Dr. L. Liejewski, AFRL, Eglin AFB, FL 32542, designed and executed the test. E. Rolland Heim Sverdrup Technology, MS 6001, Arnold AFB TN, 37388, an AEDC project engineer, conducted the experiment. A generic finned-store shape and a clipped delta wing with a 45-degree leading edge sweep were the primary test articles. Store pressure data were acquired with a pressure model with orifices at radial locations in 36, 10-degree intervals around the store and at 8 span-wise locations from 10 to 80 percent span on both surfaces of each fin. Wing upper and lower surface orifices at locations inboard, outboard, and in the plane of the pylon also provided pressure data The pylon had orifices as well. These data requirements in combination with store size constraints required testing at locations on both the left and right sides of the wing model. However, the resultant data are from a virtual, single store released Tom the pilot's right wing. Thus, the virtual configuration is asymmetric. A force model of the store provided force and moment data at carriage for comparison with the pressure model. The rig was positioned such that the store model at carriage nearly touched the left or right pylons, as required to initiate a trajectory. The store fins were positioned at carriage in a rotated cruciform style and were numbered such that Fin 1 is positioned 45 degrees ccw of the pylon looking upstream.
Derived from text
Computational Fluid Dynamics; Wind Tunnel Tests; Wings; Pressure Measurement; Delta Wings; Finned Bodies

20010067674 Air Force Research Lab., Air Vehicles Directorate, Wright-Patterson AFB, OH USA
BACK TO THE FUTURE: HOW ACTIVE AEROELASTIC WINGS ARE A RETURN TO AVIATION'S BEGINNINGS AND A SMALL STEP TO FUTURE BIRD-LIKE WINGS
Pendleton, Ed, Air Force Research Lab., USA; Active Control Technology for Enhanced Performance Operational Capabilities of Military Aircraft, Land Vehicles and Sea Vehicles; June 2001, pp. K3-1 - K3-7; In English; See also 20010067671; Original contains color illustrations; Copyright Waived; Avail: CASI; A02, Hardcopy

The evolution of birds has brought to the world a series of magnificent, optimized flyers. Flyers optimized by nature for weight and energy. Flyers that use their features, bones, muscles, nerves, ligaments, and wing flexibility to soar through the air. With nearly one hundred years of aviation development behind us, there are many that argue that aeronautics is a sunset technology. But consider this thought. Nature has always required that aerodynamic shapes must change to be optimum through various speed regimes. Until technologies similar to those used by the birds are developed, the ability to achieve true optimums in shape will never fully be achieved. Until technologies are developed that can optimally integrate aerodynamics, flight controls, with flexible lifting surfaces to maximize performance while minimizing energy and weight, aeronautics is not at its sunset, it is not even noon.
Derived from text
Aerodynamics; Aeroelasticity; Flexible Wings; Flight Control

20010067691 Deutsches Zentrum fuer Luft- und Raumfahrt e.V., Inst. fuer Stroemungsmechanik, Goettingen, Germany
ACTIVE DYNAMIC FLOW CONTROL STUDIES ON ROTOR BLADES
Geissler, W., Deutsches Zentrum fuer Luft- und Raumfahrt e.V., Germany; Trenker, M., Deutsches Zentrum fuer Luft- und Raumfahrt e.V., Germany; Sobieczky, H., Deutsches Zentrum fuer Luft- und Raumfahrt e.V., Germany; Active Control Technology for Enhanced Performance Operational Capabilities of Military Aircraft, Land Vehicles and Sea Vehicles; June 2001, pp. 17-1 - 17-9; In English; See also 20010067671; Original contains color illustrations; Copyright Waived; Avail: CASI; A02, Hardcopy

Higher Harmonic Control (HHC) and Individual Blade Control (IBC) technologies have reduced noise and vibration levels of rotors considerably. Further improvements are expected with on-blade devices, i.e., the rotor blade is active only along a limited spanwise section of high aerodynamic efficiency. On both advancing and retreating sides of the rotor disk local supersonic areas terminated by shock waves play a dominant role with respect to separation (dynamic stall) and buffet (moving shock) problems. The present paper deals with new design methodologies to deform blade sections dynamically. The objective of airfoil deformation is to avoid strong shock waves which are responsible for shock induced separation (dynamic stall) on the retreating blade and which are the origin of high speed impulsive noise levels on the advancing blade. A combination of different software components available at DLR Institute of Fluid Mechanics, i.e., Geometry Generation Tools and 2D-Time Accurate Navier-Stokes Codes, have already shown their strong potential for the development of dynamic flow control devices. This system will be used intensively in the present study and systematically applied to separation and shock control problems.
Author
Active Control; Flow Distribution; Harmonic Control; Computerized Simulation; Rotary Wings

20010067701 Deutsches Zentrum fuer Luft- und Raumfahrt e.V., Brunswick, Germany
ACTIVE/ADAPTIVE ROTOR BLADE CONTROL FOR DISTURBANCE REJECTION AND PERFORMANCE ENHANCEMENT
Kube, R., Deutsches Zentrum fuer Luft- und Raumfahrt e.V., Germany; Schimke, D., Eurocopter Deutschland G.m.b.H., Germany; Jaenker, P., DaimlerChrysler Aerospace A.G., Germany; Active Control Technology for Enhanced Performance Operational Capabilities of Military Aircraft, Land Vehicles and Sea Vehicles; June 2001, pp. 29-1 - 29-11; In English; See also 20010067671; Original contains color illustrations; Copyright Waived; Avail: CASI; A03, Hardcopy

As part of a program for development of active/adaptive rotor systems, flight tests were performed with a helicopter featuring a powerful blade root actuation system and a comprehensive sensor instrumentation. The test results gave a deep insight in the mecha-

nisms involved in the reduction of blade-vortex interaction (BVI) noise emissions and fuselage vibrations through 2/rev blade root control inputs and allowed the derivation of an algorithm for online estimation of the BVI noise emissions experienced on ground. In combination with a closed loop control law it yields a system which allows an automatic reduction of the rotor disturbances on the basis of local blade surface pressure measurements. The closed loop system can also be applied to a trailing edge flap which has been realized and investigated in the Transonic Wind Tunnel Gottingen (TWG) in the second part of the active/adaptive rotor development program. The test results demonstrated the ability of a servo flap to twist the blade to a degree which is required for rejection of the rotor disturbances and enhancement of the rotor performance.
Author
Adaptive Control; Active Control; Blade-Vortex Interaction; Rotors; Wind Tunnel Tests

20010067707 Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Inst. of Structural Mechanics, Brunswick, Germany
ADAPTIVE WING MODEL FOR WIND CHANNEL TESTS
Campanile, L. F., Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; Carli, V., Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; Sachau, D., Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; Active Control Technology for Enhanced Performance Operational Capabilities of Military Aircraft, Land Vehicles and Sea Vehicles; June 2001, pp. 4-1 - 4-15; In English; See also 20010067671; Original contains color illustrations; Copyright Waived; Avail: CASI; A03, Hardcopy

The aim of this work is to realize an adaptive wind channel wing model by means of a 'structronic' concept. The desired geometry changes are achieved through the use of the structural flexibility, and no moveable parts are required. The wind channel model presents two active sections: the 'bump' section, on the upper surface of the airfoil, and the adaptive trailing edge. The changes of the airfoil geometry by means of these parts of the model make possible to vary the distribution of the aerodynamic load on the wing. The activation of the bump and of the trailing edge is realized by means of solid state actuators. A system of about two hundred shape memory alloy actuators is used. The actuators give here also a contribution to the stiffness of the structure. Here the numerical results of the FEM investigations are presented, as well as the experimental results on the prototypes of the adaptive trailing edge and the bump actuators.
Author
Actuators; Wind Tunnel Tests; Airfoils; Trailing Edges; Flexible Wings

20010067717 Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Inst. of Structural Mechanics, Brunswick, Germany
ADAPTIVE ROTOR BLADE CONCEPTS: DIRECT TWIST AND CAMBER VARIATION
Bueter, A., Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; Ehlert, U.-C., Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; Sachau, D., Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; Breitbach, E., Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; Active Control Technology for Enhanced Performance Operational Capabilities of Military Aircraft, Land Vehicles and Sea Vehicles; June 2001, pp. 19-1 - 19-11; In English; See also 20010067671; Copyright Waived; Avail: CASI; A03, Hardcopy

Applying adaptronics to helicopters has a high potential to significantly suppress noise, reduce vibration, and increase the overall aerodynamic efficiency. Since the interaction of nonstationary helicopter aerodynamics and elastomechanical structural characteristics of the helicopter blades causes flight envelope limitations, vibration and noise, a good comprehension of the aerodynamics is essential for the development of structural solutions to effectively influence the local airflow conditions and finally develop a structural concept. With respect to these considerations, this paper presents recent investigations on two different structural concepts: the direct twist and the camber variation concept.
Author
Structural Design; Vibration Damping; Rotors; Twisting

03
AIR TRANSPORTATION AND SAFETY

19990026322 Aeronautical Systems Div., Wright-Patterson AFB, OH USA
CORROSION AND FATIGUE: SAFETY ISSUE OR ECONOMIC ISSUE
Lincoln, John W., Aeronautical Systems Div., USA; Fatigue in the Presence of Corrosion; March 1999; 5p; In English; See also 19990026320; Copyright Waived; Avail: CASI; A01, Hardcopy; A03, Microfiche

Corrosion and fatigue separately have both led to serious safety as well as economic problems. Corrosion alone, in forms such as uniform corrosion or exfoliation, may reduce the strength of aircraft and lead to failure. Both of these forms of corrosion may lead also to expensive component repair or replacement. There are many cases where corrosion alone is not significant from a safety consideration, but is a very significant economic problem. In the case of corrosion alone, one must judge the seriousness of this problem on an individual basis. Nondestructive inspections have found fatigue problems where there is essentially no influence from corrosion. Researchers have documented many cases over the years where the consequences were catastrophic. The results of fatigue cracking have caused many expensive repairs and modifications to the structure including component replacement. Fatigue often combines synergistically with corrosion. In these cases, the term corrosion fatigue is more appropriate. In most cases, corrosion, fatigue, or corrosion fatigue becomes a safety consideration only when either maintenance is not performed properly or the maintenance program is inappropriate. Experience derived from diligent maintenance has repeatedly shown that the operator need not compromise safety resulting from these problems. The purpose of this paper is to describe some experiences with corrosion, fatigue, and corrosion and fatigue and to review some of the relative literature on this subject.
Author
Fatigue (Materials); Corrosion; Structural Failure; Aircraft Maintenance; Aircraft Structures; Nondestructive Tests; Inspection; Corrosion Tests; Fatigue Tests

19990092817 National Research Council of Canada, Flight Research Lab., Ottawa, Ontario Canada
ENHANCED AND SYNTHETIC VISION SYSTEM CONCEPT FOR APPLICATION TO SEARCH AND RESCUE MISSIONS
Swail, Carl, National Research Council of Canada, Canada; Jennings, Sion, National Research Council of Canada, Canada; Sensor Data Fusion and Integration of the Human Element; February 1999, pp. 15-1 - 15-6; In English; See also 19990092805; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

The Flight Research Laboratory of the National Research Council (NRC) in cooperation with the Department of National Defense and and industrial collaborators, Canadian Marconi Company, and CAE electronics LTD is working to integrate new cockpit technologies to improve mission effectiveness and system safety of Search and REscue (SAR) missions conducted from helicopters. Search and Rescue aircraft operate in a demanding environment, often in remote areas, at night or in inclement weather. Cockpit systems that reduce pilot workload and improve pilot situational awareness can save lives when appropriately integrated into the aircraft. NRC and partners are building an enhanced and synthetic vision system (ESVS) to help SAR helicopter pilots complete their missions in degraded visual environments. The ESVS will provide SAR pilots with a real time display that mimics visual flight rules conditions. NRC plans to integrate and evaluate a prototype system by the year 2000. The prototype system will include a visually coupled helmet mounted display (HMD) system, a synthetic image generated from a terrain database, an advanced sensor and an image fusion system. A complementary research program is underway at NRC to investigate fundamental human-machine interface issues relevant to the proposed prototype system.
Author
Display Devices; Enhanced Vision; Helmet Mounted Displays; Man Machine Systems; Night; Rescue Operations; Pilot Support Systems

20000011737 Survival Systems Ltd., Dartmouth, Nova Scotia Canada

HIGH FIDELITY SURVIVAL TRAINING FOR DITCHED AIR-CREW AND PASSENGERS

Bohemier, A., Survival Systems Ltd., Canada; Brooks, C. J., Survival Systems Ltd., Canada; Morton, J. S., Survival Systems Ltd., Canada; Swain, J. H., Survival Systems Ltd., Canada; Current Aeromedical Issues in Rotary Wing Operations; August 1999, pp. 2-1 - 2-19; In English; See also 20000011735; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

When Survival Systems was established in 1982, it was decided that the sole purpose of our existence was: To enhance and preserve workers' lives through safety education, training technologies, and applied research and development. The principle people at risk were those that flew over water for a living whether pilots, crewmen, or passengers. It was decided to focus on emergency evacuation training for them. To be global leaders in our work (our service) required that we needed to enroll not only our clients, but also our own people in an exciting, seemingly unreachable, significant vision. The end result of this strategic intent would affect every human being who may have to react to, escape, egress from, affect a rescue, or survive a life-threatening situation over water or on land worldwide. It was determined that the global standards we were attempting to establish in every case would include practical training, the most modern equipment and simulation technologies, and the research and development conducted to maintain this global market leadership. Survival Systems Limited's strategic objective was to: Create, set, and maintain the standard or measurement by which all aircrew and passengers (fixed wing or rotary wing) (military or civilian) in the world will be trained to survive an emergency ditching or crash situation. Over a decade ago, Survival Systems adopted the premise that egressing a downed, flooded helicopter is a survivable event. Further, a trainee success rate approaching 100% in actual emergency egress situations could be achieved with a training protocol that replicated all variables of a true ditching. In addition, it was believed that through learned emergency response techniques, aircrew and passengers could significantly reduce ditching impact injuries. High-fidelity training programs were designed to prepare an individual to save his / her own life and the lives of others. Our team holds a moral obligation to ensure that trained aircrew can survive actual emergency situations. Survival System's original ditching training programs were developed for civilian, offshore workers. Their companies, concerned with operational efficiency, insisted on absolute safety, ease of personnel training, and as close to 100% successful course completion as possible.

Author

Flight Crews; Aircraft Survivability; Ditching (Landing); Human Factors Engineering; Training Simulators; Rotary Wing Aircraft; Pilot Training

20000011740 Gesellschaft fuer Angewandte Fernerkundung, Cologne, Germany

PRIMARY AND SECONDARY AIR MEDICAL TRANSPORT IN AMBULANCE HELICOPTERS

Roedig, Erich, Gesellschaft fuer Angewandte Fernerkundung, Germany; Current Aeromedical Issues in Rotary Wing Operations; August 1999, pp. 5-1 - 5-5; In English; See also 20000011735; Copyright Waived; Avail: CASI; A01, Hardcopy; A03, Microfiche

In all imaginable situations going along with medical emergencies, time is the crucial determinant which can make the difference between life and death. In medicine it is a well proved axiom that one can influence and improve the prognosis of casualties once qualified medical support has been initiated. To shorten the interval for wounded soldiers or patients in lack of adequate therapy, emergency medicine seeked the advantages of helicopters to provide medical care at the earliest possible time and to guarantee a very effective and rapid response to life-threatening situations. Air rescue medicine has developed extensively over the past 60 years and is still changing. The increasing engineering progress in aviation and the current state-of-the-art medical equipment opened the way for helicopters and fixed wing aircraft to perform as modern, highly mobile intensive care centers. The air ambulance service represents a complex, demanding and responsible working place for aircrews and specialized medical personnel. Therefore, professional expertise and procedures are mandatory to understand and carry out critical care interventions in the Air Medical Transport (AMT) environment. Experienced and well trained personnel and the optimized preparation of the patient before take-off ensure effective medical care in flight over long distances.

Author

Air Transportation; Medical Services; Aerospace Medicine; Rotary Wing Aircraft; Medical Personnel; Flight Crews; Ambulances; Sarsat

20000011743 Helicopter Emergency Medical Services, Rotterdam, Netherlands

SOMETHING NEW: ALL TOGETHER!

vanAggelen, G. P., Helicopter Emergency Medical Services, Netherlands; Rutten, F. L. P. A., Helicopter Emergency Medical Services, Netherlands; Schildkamp, G. J., Helicopter Emergency Medical Services, Netherlands; Breeman, W., Helicopter Emergency Medical Services, Netherlands; deVos, A., Helicopter Emergency Medical Services, Netherlands; Current Aeromedical Issues in Rotary Wing Operations; August 1999, pp. 9-1 - 9-8; In English; See also 20000011735; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

The Rotterdam HEMS (Helicopter Emergency Medical System) has been operating since August 1 1997. It is a pilot project for the Netherlands South West, meant to improve the delivery of prehospital care and closely monitored by the Ministry of Health, the Air Force and Navy. Over 650 flights have been made in the first year, mostly first response flights and missions at the request of ambulance services on-scene. Increasingly, interhospital transfers and on scene thrombolysis are being performed, however. This article focuses on the organizational aspects, as well as training and quality assurance of the program. The 3 member crew consists of a pilot, EMT (Emergency Medical Technician)-nurse and a senior resident of the University Hospital anesthesiology program, 2 of whom are Dutch military flight surgeons, USN (USA Navy) and USAF (USA Air Force) trained, respectively. Required medical training beforehand included ATLS Advanced Trauma Life Support), ACLS (Advanced Cardiac Life Support) as well as aeromedical transport and Emergency medicine experience. The training program for the crew included teambuilding, under water escape training and in-house crewmember cross-training, so that essential crew tasks can be performed by all, both in flight as well as on the ground. Another crewbuilding experience was ICET (International Center for Extrication Techniques, Raamsdonkveer, the Netherlands)-training, where advanced extrication techniques were practiced. Crew Resource Management programs are being developed, since standard industry programs are not applicable. The concept of HEMS in a densely populated country like the Netherlands has met with some fierce resistance in local ambulance services and dispatchers, making it necessary to come up early with a well-defined educational and information providing program. Quality assurance (QA) is an important issue. Cases are extensively reviewed, beginning with after-action debriefing sessions with ground EMS (Emergency Medical Service)-personnel. Evaluation involving all crewmembers and patient follow-up after the incident is standard. Some highlighted cases are regionally discussed in monthly review sessions with ambulance crews amd dispatchers from the area of operation. We feel a pro-active approach, including QA, is essential for long term success.

Author

Aerospace Medicine; Emergencies; Flight Surgeons; Flight Crews; Flight Nurses; Quality Control; Education

20000011746 Royal Norwegian Inst. of Aviation Medicine, Oslo, Norway

HEALTH, ENVIRONMENT AND SAFETY (HES) IN MILITARY AVIATION: IMPLICATIONS FOR THE RNOAF NEW SEARCH AND RESCUE (SAR) PROGRAM

Fonne, Vivianne, Royal Norwegian Inst. of Aviation Medicine, Norway; Wagstaff, Anthony S., Royal Norwegian Inst. of Aviation Medicine, Norway; Current Aeromedical Issues in Rotary Wing Operations; August 1999, pp. 13-1 - 13-5; In English; See also 20000011735; Copyright Waived; Avail: CASI; A01, Hardcopy; A03, Microfiche

The RNoAF (Royal Norwegian Air Force) Institute of Aviation Medicine has been involved in developing a quality control system for military aviation in order to emphasize and improve occupational health and safety in the military aviation operational environment. A new military regulation has been developed to ensure Human Factors evaluations of all new systems and aircraft. The RNOAF New Search And Rescue Program represents one of the first

projects in which personnel from the RNOAF Institute of Aviation Medicine have been involved as an integral part of the project process. The work was performed in close cooperation with other sections of the RNOAF, in particular the Air Material Command/Test Pilot Office and the Flight Inspectorate, together the 3 organizations were responsible for coordinating all technical, operational and human factors aspects related to the project. The recently implemented regulation, requiring Human Factor evaluations on all new aircraft and equipment for the RNOAF, has led the way to a new and structured focus in military aviation. This focus implies not only a direction towards increased emphasis on what is viewed as the primary cause factor for aircraft accidents today, but provides a system for improving the crew's health and safety in an operational environment.
Author
Aerospace Medicine; Human Factors Engineering; Rescue Operations; Environmental Quality; Health Physics; Searching; Test Pilots

20000011755 Naval Air Warfare Center, Aircraft Div., Patuxent River, MD USA
NAVAL AND MARINE CORPS ROTARY WING OVER WATER MISHAPS AND THE LIFE RAFT IMPROVEMENT PROGRAM
Loeslein, G. F., Jr., Naval Air Warfare Center, USA; ORourke, C. R., Naval Air Warfare Center, USA; Kinker, Lawrence E., Flight Dynamics and Safety, Inc., USA; Current Aeromedical Issues in Rotary Wing Operations; August 1999, pp. 22-1 - 22-5; In English; See also 20000011735; Copyright Waived; Avail: CASI; A01, Hardcopy; A03, Microfiche

U.S. Navy Instruction (OPNAVINST 3710.7Q) states 'Life rafts of sufficient capacity to accommodate passengers and crew shall be provided in all aircraft when there would be a significant risk of water entry in the event of a mishap'. The inability to successfully deploy life rafts in over water ditching scenarios has long been recognized by helicopter aircrews in the U.S. Navy and Marine Corps. The rafts' size and weight limits the stowage options and impacts the deployment characteristics of current aviation life rafts. A proposal co-sponsored by the Aircraft Equipment Reliability and Maintainability Improvement Program (AERMIP) and the Affordable Readiness Program has targeted current life raft technology in addressing these deployment issues. By taking advantage of this technology, the U.S. Navy can provide the aviation community with a state-of-the-art life raft that will dramatically improve the deployment capabilities as well as, reducing current maintenance inspections and logistical support requirements. This paper will address new raft materials, shapes, sizes, inflation systems, along with other design features including life raft capacity as it will apply to current and future aircraft assets. The monetary benefits will also be addressed. In addition, the options for incorporation of improved manual/automatic deployment systems that are internally/externally mounted will be presented.
Author
Life Rafts; Aircraft Equipment; Rotary Wing Aircraft; Armed Forces (United States); Navy; Design Analysis; Deployment

20000011756 Defence and Civil Inst. of Environmental Medicine, Toronto, Ontario Canada
THE ABYSMAL PERFORMANCE OF THE INFLATABLE LIFERAFT IN HELICOPTER DITCHINGS
Brooks, C. J., Defence and Civil Inst. of Environmental Medicine, Canada; Potter, P. L., CORD Group Ltd., Canada; Current Aeromedical Issues in Rotary Wing Operations; August 1999, pp. 23-1 - 23-10; In English; See also 20000011735; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

The inflatable liferaft or dinghy was introduced into aircraft in the 1930s. The Royal Navy Fleet Air Arm and the Royal Canadian Air Force suspended it between the longerons at the aft end of the biplane fuselage. Just prior to World War II, the free-floating multi-seat dinghy was added to the inventory of aviation lifesaving equipment. 35% of the 4 - 5000 ditchings in World War II and the Korean War were reviewed. It was concluded that the liferaft had been of great value, but in virtually every case there was reference to a struggle to get into it. This was only made worse if the crewmember was injured or simply exhausted. Many survivors recommended deflating the liferaft before entry and/or climbing into an uninflated liferaft before inflating it. In 1965, inflatable liferaft performance in commercial fixed wing aircraft accidents was reviewed. It was concluded that often the installation of life support equipment had been done as an after-thought when the rest of the aircraft design had been completed, and in many cases, imperfect installation had not improved survival. There are many similar comparisons with introduction of the inflatable liferaft into helicopters post World War II.
Derived from text
Inflatable Structures; Life Rafts; Ditching (Landing); Rotary Wing Aircraft; Helicopter Design; Aircraft Survivability; Flight Crews

20000011768 Institute of Naval Medicine, Gosport, UK
HELICOPTER UNDERWATER ESCAPE AND THE INITIAL RESPONSES TO COLD
Tipton, Michael J., Portsmouth Univ., UK; Current Aeromedical Issues in Rotary Wing Operations; August 1999, pp. 36-1 - 36-5; Repr. from Aviation, Space and Environmental Medicine, v. 68, no. 10, 1997 p 906-991; In English; See also 20000011735; Copyright Waived; Avail: CASI; A01, Hardcopy; A03, Microfiche

The initial responses to immersion in cold water represent one of the first major hazards to be faced by individuals in a ditched helicopter. The acceptance of this fact has led to the provision by some organizations of emergency underwater breathing aids (EUBA). In this paper two approaches to the provision of an EUBA have been examined - this goes some way to address the paucity of published work in this area.
Author
Water Immersion; Underwater Breathing Apparatus; Cold Water; Flight Crews; Aerospace Medicine; Emergencies

20000011769 Naval Air Warfare Center, Aircraft Div., Patuxent River, MD USA
US NAVAL AND MARINE CORPS HELICOPTER MISHAP TRENDS: OVER WATER MISHAPS (1985-1997)
Contarino, RaNae, Naval Air Warfare Center, USA; Loeslein, George F., Jr., Naval Air Warfare Center, USA; Kinker, Lawrence E., Flight Dynamics and Safety, Inc., USA; Current Aeromedical Issues in Rotary Wing Operations; August 1999, pp. 37-1 - 37-7; In English; See also 20000011735; Original contains color illustrations; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

U.S. Navy and Marine Corps helicopter mishaps, occurring over water, were examined under the Naval Air Systems Command sponsored Advanced Crashworthy Aircrew Survival Systems (ACASS) Program. The charter of the ACASS program is to increase levels of safety and survivability for aircrew and passengers involved in mishaps. Problems concerning airframe crashworthiness and mishap victim survivability during and after a crash were identified through the study of data provided by the USA Naval Safety Center. Studying mishap data provides a key starting point towards improvement of airframe crashworthiness and allows justifying what types of new and emerging technologies should be chosen to improve safety and to lessen occurrences of injury among mishap victims. For the purpose of this study, over water mishaps involving AH-1, UH-1, H-46, H-53, and H-60 helicopters were examined between the time period of 1 October 1985 through 30 September 1997. Findings will be used to support continued U.S. Navy research in areas of airframe safety, occupant seating and restraint postcrash survivability, and improving survival equipment.
Author
H-53 Helicopter; Uh-1 Helicopter; H-60 Helicopter; Crashworthiness; Flight Crews; Navy; Ah-1w Helicopter; Ch-46 Helicopter

20000011770 German Army Aviation School, Bueckeburg, Germany
HELICOPTER FLIGHT ACCIDENTS IN THE GERMAN FEDERAL ARMED FORCES IN THE LAST 15 YEARS
Marwinski, Hans-D., German Army Aviation School, Germany; Current Aeromedical Issues in Rotary Wing Operations; August 1999, pp. 38-1 - 38-8; In English; See also 20000011735; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

This presentation deals with flight accidents made with helicopters of the Bundeswehr in the period of 1 January 1984 until today. Given a total rate of 0.22 accidents per 10.000 hours, that is 48 accidents in a total of 2.2 million hours, the number of flight accidents can be stated as low; 47 persons were killed and 48 helicopters destroyed. The intensive efforts invested in flight safety within die Bundeswehr are successful. The same applies to the intensive and

continuous aeromedical care and control of flying personnel, which are ensured centrally by the Air Force Institute of Aviation Medicine and locally in the flying units and during operations by well trained and experienced flight surgeons. The flight accident rate will probably improve even more of Crew Coordination and Management concepts are implemented and further developed. For this, however, efforts must be made to increase the acceptance of these concepts particularly among senior flying personnel. A closer look at the helicopter flight accidents situation shows that most of the accidents are due to two flight physiological phenomena: spatial disorientation and empty field myopia. Special consideration will be granted to the aerodynamic peculiarities of a hingeless rotor system, the knowledge and respect of which will help to prevent accidents especially when flying in a low-altitude profile.
Derived from text
Aerospace Medicine; Armed Forces (Foreign); Aircraft Accidents; Psychological Effects; Human Factors Engineering; Bo-105 Helicopter; Uh-1 Helicopter; H-53 Helicopter

20000011771 Army Aeromedical Research Lab., Fort Rucker, AL USA
BENEFIT OF CRASHWORTHY DESIGN IN ATTACK HELICOPTERS: A COMPARISON OF ACCIDENT FATALITY RATES
Crowley, J. S., Army Aeromedical Research Lab., USA; Current Aeromedical Issues in Rotary Wing Operations; August 1999, pp. 40-1 - 40-5; In English; See also 20000011735; Copyright Waived; Avail: CASI; A01, Hardcopy; A03, Microfiche

Several NATO (North Atlantic Treaty Organization) forces are currently procuring the latest version of the highly successful AH-64 Apache helicopter. As part of a program safety review, the literature was reviewed for evidence of an overall survival benefit of crashworthy helicopter design, as incorporated in the AH-64A. This benefit has been previously demonstrated in utility helicopters. Occupant survival in Class A-C AH-64A Apache accidents occurring from 1972-1996 was compared to survival during the same time period in AH-1 Cobra accidents. The analysis showed that the mortality rate was considerably higher for the AH-1, particularly in the 3555 ft/sec vertical impact range. Head injuries were less frequent in survivable crashes involving the AH-64A than in survivable AH-1 crashes. These results, combined with the work of others, appear to confirm the benefit of crashworthy design in attack helicopter crash survival.
Author
Crashworthiness; Helicopter Design; North Atlantic Treaty Organization (NATO); Ah-64 Helicopter; Uh-60a Helicopter; Uh-1 Helicopter; Aircraft Survivability

20000011776 Defence Evaluation Research Agency, Centre for Human Sciences, Farnborough, UK
BRITISH ARMY HELICOPTER CASUALTY EVACUATIONS IN BELIZE (1995-1996)
Eke, A. J., Defence Evaluation Research Agency, UK; Current Aeromedical Issues in Rotary Wing Operations; August 1999, pp. 8-1 - 8-4; In English; See also 20000011735; Copyright Waived; Avail: CASI; A01, Hardcopy; A03, Microfiche

The British Army Training Support Unit Belize supports jungle training for British military sub-units, and for the Belizean Defence Force. Training is carried out at remote jungle and mountain sites. The economic infrastructure of Belize is such that few substantial roads exist. A few main routes link the handful of major population centres but even these main highways are impassable by civilian vehicles under rainy conditions. Access to rapid medical aid is also impeded by the dispersion of medical facilities. There has been a British military presence in Belize since the 1970s, and the Government of Belize has been assisted since then by moving casualties by air when necessary. After the withdrawal of Royal Air Force Puma helicopters from Belize in 1994, the role of casualty evacuation passed to 25 Flight Army Air Corps, who were equipped with Gazelle helicopters. Whilst the Puma is a large twin-engined helicopter, the Gazelle is a small, single-engined observation and reconnaissance aircraft. Details of the casualty evacuations carried out during 1995 and 1996 were collated and analysed in order to provide information on casualty types, and the locations from which casualties had been evacuated, during this 2 year period. A total of 192 casualties were transported by 25 Flt AAC (Flight Army Air Corps). Of these, 119 were British military personnel, 49 were Belizeans and 24 were foreign nationals. Thirty six evacuations took place wholly or partly at night. The majority of British military evacuations took place from jungle or mountain locations, predominantly for accidents or heat illness. Evacuations of Belizeans were mostly from town or jungle locations and foreign nationals from the cayes. The commonest cause for both these groups was accidents. The data were used to ensure the provision of an appropriately equipped CASEVAC (Casualty Evacuations) helicopter, and to highlight common causes of significant morbidity in British troops deployed to Belize.
Author
Belize; Casualties; Reconnaissance Aircraft; Deployment; Evacuating (Transportation); Military Helicopters

20000032388 Research and Technology Organization, Human Factors and Medicine Panel, Neuilly-sur-Seine, France
MODELS FOR AIRCREW SAFETY ASSESSMENT: USES, LIMITATIONS AND REQUIREMENTS *[LA MODELISATION DES CONDITIONS DE SECURITE DES EQUIPAGES: APPLICATIONS, LIMITATIONS ET CAHIERS DES CHARGES]*
August 1999; 360p; In English; 26-28 Oct. 1998, Wright AFB, OH, USA; See also 20000032389 through 20000032420; Original contains color illustrations
Report No.(s): RTO-MP-20; AC/323(HFM)TP/7; ISBN 92-837-1017-7; Copyright Waived; Avail: CASI; A16, Hardcopy; A03, Microfiche

These proceedings include the Technical Evaluation Report, a tribute to Dr. Henning E. von Gierke, Director Emeritus, Wright-Patterson Air Force Base (WPAFB), OH, three Keynote Addresses and 32 invited papers of a Specialists' Meeting sponsored by the NATO/RTO Human Factors and Medicine Panel. It was held at WPAFB from 26-28 October 1998. Significant advances have been made in modelling human physical and physiological responses to extreme environments. Technological advances in computer speed and power have made modelling a feasible research and design tool. Computer simulations are being used extensively for predicting human physical and physiological responses, for reducing testing requirements, for rapidly designing improved protective systems, and for performing human safety-systems analyses. A variety of models were reviewed at this Specialists' Meeting including lumped-parameter, rigid-body, finite-element, statistical, physiologic, and empirical models. Topics covered included modelling human-body responses to environmental stressors, and the systems with which the body interacts to impact, emergency escape, sustained acceleration, vibration, mechanical shock, motion sickness, high altitude, blast, extreme thermal conditions, directed energy, and live firing. These proceedings will be of interest to military and civilian scientists and engineers interested in exploiting data bases, tolerance critefia, and new models and methods in the research of physiological systems and in simulating the design, test set up and evaluation of safety systems.
Author
Computerized Simulation; Conferences; Human Factors Engineering; Mathematical Models; Flight Crews; Safety Factors; Human Body; Physiological Responses

20000032400 Missouri Univ., Dept. of Mechanical and Aerospace Engineering and Engineering Mechanics, Rolla, MO USA
FORCES AND DEFORMED CONFIGURATIONS OF AN AIRBAG DURING INFLATION AND IMPACT
Avula, Xavier J. R., Missouri Univ., USA; Kaleps, Ints, Air Force Research Lab., USA; Mysore, Prasad, Missouri Univ., USA; Models for Aircrew Safety Assessment: Uses, Limitations and Requirements; August 1999, pp. 12-1 - 12-14; In English; See also 20000032388
Contract(s)/Grant(s): F41624-95-C-6014; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

In this work, the evolution of forces and deformed configurations of an airbag during inflation and impact with a rigid sphere were investigated for various airbag parameters. The parameters considered were fabric density, bag elasticity, input gas temperature and vent size. The computations were performed using a non-linear finite element method coded in the LS-DYNA3D package. The influence of the above mentioned parameters on the contact during the impact was significant: lowering the fabric density resulted in higher bag velocity which in turn resulted in higher rebound velocity of an impacting sphere; fabrics of lower elasticity had shown increased contact time and higher rebound velocity; the lower the input gas temperature, the longer was the contact time and the lower the rebound velocity of the sphere. The acceleration and rebound velocity had an inverse relationship with vent area. These observa-

tions with additional studies could be used in the development of better occupant safety systems.
Author
Air Bag Restraint Devices; Finite Element Method; Human Factors Engineering; Deformation; Loads (Forces); Inflatable Structures; Impact Damage

20000032865 Textron Bell Helicopter, Fort Worth, TX USA
APPLICATION OF DAMAGE TOLERANCE TO INCREASE SAFETY OF HELICOPTERS IN SERVICE
Krasnowski, Bogdan R., Textron Bell Helicopter, USA; Application of Damage Tolerance Principles for Improved Airworthiness of Rotorcraft; February 2000, pp. 7 - 1 - 7 - 8; In English; See also 20000032859; Copyright Waived; Avail: CASI; A02, Hardcopy

In the past, all helicopters have been designed to safe-life requirements. Introduced in October 1989, FAR 29.571 at Amendment 28 requires damage tolerance substantiation for transport category helicopters. Therefore, the majority of helicopters currently in service were designed to safe-life requirements. In general, the safe-life approach has proven to be adequate. However, there have been a number of field problems with cracking components, which lend themselves to the application of a damage tolerance approach. Damage tolerance analysis allows addressing the safety of the cracking components by: Evaluation of the field cracking, supported by the laboratory evaluation of the field-returned cracks; Establishment of the inspection interval in conjunction, if necessary, with operation limitations; and Specification of fixes to be applied to the structure to either increase the inspection limit and/or lift the operation limitations. To accomplish the above listed tasks, crack growth analysis is performed using the appropriate usage spectrum and the flight load survey data. If necessary, usage spectrum reviews and additional flight load surveys could be required. The crack growth analysis results are verified by the laboratory evaluation of the cracked components, and if necessary by the additional crack growth testing of the field-returned components with cracks or the pre-cracked components.
Author
Crack Propagation; Tolerances (Mechanics); Damage; Helicopters; Cracks; Aircraft Safety; Helicopter Design

20000032866 Agusta A. Finmeccanica Co., Cascina Costa di Samarate, Italy
AGUSTA EXPERIENCE ON DAMAGE TOLERANCE EVALUATION OF HELICOPTER COMPONENTS
Mariani, Ugo, Agusta A. Finmeccanica Co., Italy; Candiani, Luigi, Agusta A. Finmeccanica Co., Italy; Application of Damage Tolerance Principles for Improved Airworthiness of Rotorcraft; February 2000, pp. 8 - 1 - 8 - 12; In English; See also 20000032859; Copyright Waived; Avail: CASI; A03, Hardcopy

Within the fatigue evaluation of the EHI0I, Agusta has carried out a specific program of flaw tolerance evaluation of the primary loading path. The program is close to completion and this paper provides a summary of the most relevant results. For composite components, damage size was increased considering both manufacturing discrepancies greater than the minimum quality standard and impact damages clearly detectable during visual inspections. The favourable data achieved are based on the 'no growth' concept. The metal parts of the main rotor head were evaluated by enhanced safe life method and fail safe capability. The slow crack growth approach was instead applied for the Rear Fuselage End Fittings, which connect the Tail Unit. All these evidences can be used in addition to the comprehensive safe life evaluation of the aircraft to improve the maintenance and the repair actions. Based on this experience, application of flaw tolerance criteria will be carried out on the new helicopters in development phase.
Author
Eh-101 Helicopter; Composite Materials; Crack Propagation; Impact Damage; Tolerances (Mechanics); Helicopters; Aircraft Structures; Fiber Composites

20000105075 Department of the Air Force, Kirtland AFB, NM USA
THE COST/BENEFIT OF AGING ON SAFETY AND MISSION COMPLETION IN AVIATION PROFESSIONS
King, R. E., Department of the Air Force, USA; Operational Issues of Aging Crewmembers; August 2000, pp. 17-1 - 17-6; In English; See also 20000105060; Copyright Waived; Avail: CASI; A02, Hardcopy

The suspected detrimental effects of aging lead to concerns about aging pilots in civilian and, to a lesser extent, military flying. The typically superior cognitive ability of all pilots, and experience of older pilots in particular, however, render them a valuable asset and dictate they be carefully assessed when concerns about their cognitive ability arise.
Author
Cost Effectiveness; Age Factor; Safety

20010002554 European Research Office (US Army), Army Research Lab., London, UK
SAFETY AND SERVICE DIFFICULTY REPORTING
Sampath, S. G., European Research Office (US Army), UK; Aging Engines, Avionics, Subsystems and Helicopters; October 2000, pp. 7-1 - 7-12; In English; See also 20010002548; Copyright Waived; Avail: CASI; A03, Hardcopy

Today, safety is considered to be of highest importance in most societies. In the context of the military, safety is essential to averting loss of life and damage to a high-value asset. While safety may take second place to winning a war, its importance is further accentuated because of its connotation to battlefield readiness. There have been numerous instances to illustrate this last point. To wit: (1) Widespread Fatigue Damage (WFD) was discovered in 'weep holes' of fuel tanks of some C-141 military transport airplanes. Because of the loss of minimum residual strength, with the attendant risk of catastrophic fracture posed by WFD, the entire fleet had to be grounded and an expensive refurbishment program had to be undertaken before the fleet was deemed to be airworthy. In this instance, the unsafe condition was detected and corrected quickly, so no lives were lost nor did any of the airplanes in the fleet suffer catastrophic damage. However, the grounded aircraft were certainly not battle-ready for a certain length of time. Had they been sent into battle, they would have had to be operated under severe flight restrictions and, thus, their utility to serve the purpose of the deployed forces would have been very restricted. Had they been deployed without any restrictions, in all probability they would have been unable to complete their missions and the Air Force could have lost valuable aircraft assets. Also, the necessary logistic support to properly carry out tactical operations in the battlefield would not have been available. (2) WFD was the primary cause of a highly publicized air accident involving a commercial aircraft. The wide publicity given to that single accident, abetted by on-site video tape recording of the condition of the aircraft after it had landed, shook the confidence of the public in the safety of commercial aviation. As a result, inspection and refurbishment of 3000 jet transport airplanes among a fleet of about 5000 was mandated by the authorities, to be undertaken on an urgent basis. The economic impact of this mandate on the airlines, the aircraft manufacturer and the flying public was high and resulted in numerous complaints to the regulatory authorities. It must be noted that since that time more than twelve years have elapsed without a single accident attributable to WFD.
Author
Aircraft Reliability; Damage; Fatigue (Materials); Fractures (Materials); Aircraft Safety; Flight Safety; Accident Prevention

20010028487 European Research Office (US Army), London, UK
SAFETY AND SERVICE DIFFICULTY REPORTING
Sampath, S. G., European Research Office (US Army), UK; Aging Aircraft Fleets: Structural and Other Subsystem Aspects; March 2001, pp. 12-1 - 12-13; In English; See also 20010028476; Copyright Waived; Avail: CASI; A03, Hardcopy

Today, safety is considered to be of highest importance in most societies. In the context of the military, safety is essential to averting loss of life and damage to a high-value asset. While safety may take second place to winning a war, its importance is further accentuated because of its connotation to battlefield readiness. There have been numerous instances to illustrate this last point. To wit: Widespread Fatigue Damage (WFD) was discovered in 'weep holes' of fuel tanks of some C-141 military transport airplanes. Because of the loss of minimum residual strength, with the attendant risk of catastrophic fracture posed by WFD, the entire fleet had to be grounded and an expensive refurbishment program had to be undertaken before the fleet was deemed to be airworthy. In this instance, the unsafe condition was detected and corrected quickly, so no lives were lost nor did any of the airplanes in the fleet suffer catastrophic damage. However, the grounded aircraft were certainly not battle-ready for a certain length of time. Had they been sent into battle, they would

have had to be operated under severe flight restrictions and, thus, their utility to serve the purpose of the deployed forces would have been very restricted. Had they been deployed without any restrictions, in all probability they would have been unable to complete their missions and the Air Force could have lost valuable aircraft assets. Also, the necessary logistic support to properly carry out tactical operations in the battlefield would not have been available. WFD was the primary cause of a highly publicized air accident involving a commercial aircraft. The wide publicity given to that single accident, abetted by on-site video tape recording of the condition of the aircraft after it had landed, shook the confidence of the public in the safety of commercial aviation. As a result, inspection and refurbishment of 3000 jet transport airplanes among a fleet of about 5000 was mandated by the authorities, to be undertaken on an urgent basis. The economic impact of this mandate on the airlines, the aircraft manufacturer and the flying public was high and resulted in numerous complaints to the regulatory authorities. It must be noted that since that time more than twelve years have elapsed without a single accident attributable to WFD. These instances explain my motivation for including the subject of safety during this Lecture Series. However, the subject is extensive and so many books have appeared that address some aspect or the other that my remarks are meant to complement the existing literature. Much of what I intend to share with you today is not something I have developed on my own, rather it has been influenced by my comrades and peers when I was in the civil aviation community.
Derived from text
Aircraft Reliability; Safety; Fracturing; Fatigue (Materials); Damage; Inspection

20010056522 Air Force Research Lab., Wright-Patterson AFB, OH USA
EJECTION SEAT CAPABILITIES TO MEET AGILE AIRCRAFT REQUIREMENTS
Specker, Larry, Air Force Research Lab., USA; Plaga, John, Air Force Research Lab., USA; Santi, Vic, Aeronautical Systems Div., USA; Human Consequences of Agile Aircraft; May 2001, pp. 121-129; In English; See also 20010056513; Original contains color illustrations; Copyright Waived; Avail: CASI; A02, Hardcopy

Current US Air Force seats provide safe aircrew escape up to about 425 Knots Equivalent AirSpeed (KEAS). The performance limit of US ejection seats is cited as 600 KEAS, but very few successful ejections have occurred over 500 KEAS. Wind blast is a cause of major injuries and fatalities at airspeeds above 425 KEAS. Adverse aircraft altitude, attitude, and roll rates are also known to degrade survival probability. Advanced, highly-maneuverable aircraft are expected to make increasing demands on initial off-axis conditions with which ejection systems must contend. A notional representation of current aircraft sideslip capabilities.
Derived from text
Ejection; Survival; Ejection Seats; Highly Maneuverable Aircraft

20020018829 Research and Technology Organization, Applied Vehicle Technology Panel, Neuilly-sur-Seine, France
ICE ACCRETION SIMULATION EVALUATION TEST *[ESSAI D'EVALUATION DE LA SIMULATION DE L'ACCUMULATION DE GLACE]*
Kind, R. J., Research and Technology Organization, France; November 2001; 32p; In English; CD-ROM contains full text document in PDF format
Report No.(s): RTO-TR-038; AC/323(AVT-006)TP/26; ISBN 92-837-1072-X; Copyright Waived; Avail: CASI; A03, Hardcopy; A01, Microfiche

The NATO-RTO Task Group assessed computer codes for the prediction of ice accretion on aeroplanes which is an important flight safety issue. The following topics were treated: 1) state of the art; 2) review codes in use or being developed; 3) provide reliability data for regulation and certification; 4) ice shape comparison methods; and 5) critical research needs. In order to compare the detail of codes a workshop was held involving experts from various institutions and companies.
Author
Computer Programs; North Atlantic Treaty Organization (NATO); Computerized Simulation; Aircraft Icing; Aircraft Performance; Aeronautics; Flight Tests

04
AIRCRAFT COMMUNICATIONS AND NAVIGATION

19990092822 DaimlerChrysler Aerospace A.G., Military Aircraft Div., Munich, Germany
TACTICAL MISSIONS OF TRANSPORT AIRCRAFT: A PROVEN LOW LEVEL GUIDANCE CONCEPT TO REDUCE CREW WORKLOAD
Lerche, H. D., DaimlerChrysler Aerospace A.G., Germany; Mehler, F., DaimlerChrysler Aerospace A.G., Germany; Sensor Data Fusion and Integration of the Human Element; February 1999, pp. 20-1 - 20-8; In English; See also 19990092805; Original contains color illustrations; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

A concept for a new flight guidance system focuses on the problem of low level flight and reduction of crew workload for a military transport aircraft is presented. A digital terrain database is used to eliminate the need for an active forward looking radar, thus permitting silent terrain following and terrain avoidance. Coupled to the database are a highly reliable, precision navigation, 4D flight guidance and display functions. The demonstration of key technologies associated with this system has been carried out in several R&D programs to prove the high maturity of available technologies and to reduce the development risks. The target aircraft for these studies is the future European tactical transport aircraft, known as Future Large Aircraft or Future Transport aircraft. The present low level flight technical solution has been prototyped and tested by the German Air Force in the Airbus Experimental Cockpit Simulator and two flying testbeds (C160 Transall, and ATTAS).The experimental verification process is still currently in progress.
Author
Data Bases; Display Devices; Navigation; Terrain; Terrain Following; Obstacle Avoidance; Transport Aircraft; Aircraft Instruments; Flight Instruments

20000012174 Litton Guidance and Control Systems, Woodland Hills, CA USA
APPLICATION OF CONING ALGORITHMS TO FREQUENCY SHAPED GYRO DATA
Mark, J. G., Litton Guidance and Control Systems, USA; Tazartes, D. A., Litton Guidance and Control Systems, USA; 6th Saint Petersburg International Conference on Integrated Navigation Systems; October 1999, pp. 2-1 - 2-11; In English; See also 20000012172; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

A key parameter of a strapdown inertial navigation system is its response to coning motion. Substantial efforts have gone into the development of sophisticated algorithms which reduce system drift errors in the presence of coning motion. Present-day algorithms use incremental angle outputs from the gyros to form high order correction terms which reduce net coning errors. These algorithms assume a flat transfer function for the processing of the incremental angle outputs and are structured to yield very high order responses. Techniques such as resolution enhancement (the subject of a previous conference paper) shape the frequency response of the gyro data and consequently degrade the performance of the conventional coning algorithms. Likewise, many gyros exhibit complex frequency responses and violate the assumptions used in deriving the previously developed coning algorithms. The mismatch between the assumed and actual frequency response of the gyro data leads to degradation of performance in a coning environment as well as amplification of pseudo-coning errors. This paper discusses a method of deriving algorithms which are tailored to the frequency response of the particular type of gyros used. These algorithms can be designed to arbitrarily high order and can also supply an extremely sharp high-frequency cutoff to minimize pseudo-coning errors. This work was motivated by the desire to use resolution enhanced ZLG (Zero-Lock Ring Laser Gyroscope) data to form the strapdown attitude solution and was heavily influenced by the most recent work in Russia on coning algorithms by Yury Litmanovich. However, the techniques developed equally apply to mechanical, fiber-optic, and other types of gyros. Extensive simulation of the new algorithms has been performed and we are now in a position to incorporate them in the Litton ZLG product line.
Author
Algorithms; Gyrofrequency; Inertial Navigation; Laser Gyroscopes; Computerized Simulation; Mathematical Models; Coning Motion

20000012180 State Research Center of the Russian Federation-Central Scientific and Research Inst. Elektropribor, Saint Petersburg, Russia

SIGNAL PROCESSING USING THE INCREMENTS OF SIGNAL MULTIPLE INTEGRALS: FROM STRAPDOWN INS TO OTHER REAL-TIME SYSTEMS

Litmanovich, Yury A., State Research Center of the Russian Federation-Central Scientific and Research Inst. Elektropribor, Russia; Lesyuchevsky, Vladimir M., State Research Center of the Russian Federation-Central Scientific and Research Inst. Elektropribor, Russia; Gusinsky, Valery Z., State Research Center of the Russian Federation-Central Scientific and Research Inst. Elektropribor, Russia; 6th Saint Petersburg International Conference on Integrated Navigation Systems; October 1999, pp. 8-1 - 8-7; In English; See also 20000012172

Contract(s)/Grant(s): RFBR-97-01-01134; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

A new approach to signal processing in strapdown INS is presented and examined with a view to apply it to the other real-time systems. The solutions for three problems of the strapdown INS (Inertial Navigation System) software, which are typical for other systems are expressed via the increments of the signal multiple integrals over the iteration interval. The possibility and utility of the signal multiple integrals generation while the signal pre-processing is discussed.

Author

Signal Processing; Strapdown Inertial Guidance; Inertial Navigation; Real Time Operation; Mathematical Models; Measure And Integration; Computer Programs

20000012181 Scientific and Research Association of Automatics, Ekaterinburg, Russia

FAULT-TOLERANT STRAPDOWN INERTIAL MEASUREMENT UNIT: FAILURE DETECTION AND ISOLATION TECHNIQUE

Vodicheva, L. V., Scientific and Research Association of Automatics, Russia; 6th Saint Petersburg International Conference on Integrated Navigation Systems; October 1999, pp. 9-1 - 9-9; In English; See also 20000012172; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

Familiar and new methods of self-contained failure detection and isolation technique in respect to sensors of redundant strapdown Inertial Measurement Unit are analyzed and systematized in the paper. Conditions of non-sensitivity of FDI (Failure Detection and Isolation) algorithms to failures are obtained. Measurement unit with any number of sensors with input axes arbitrary arranged in three-dimensional space is under consideration.

Author

Fault Tolerance; Failure; Strapdown Inertial Guidance; Mathematical Models; Inertial Navigation; Algorithms; Inertial Platforms

20000012182 Russian Inst. of Radionavigation and Time, Saint Petersburg, Russia

'SOYUZ'-'MIR' ORBITAL FLIGHT GPS/GLONASS EXPERIMENT: FIRST RESULTS

Klyushnikov, Sergey, Russian Inst. of Radionavigation and Time, Russia; Filatchenkov, Sergey, Russian Inst. of Radionavigation and Time, Russia; Mikhailov, Nicolai, Soft Nav Ltd., Russia; Pospelov, Sergey, Soft Nav Ltd., Russia; Vasilyev, Mikhail, Soft Nav Ltd., Russia; 6th Saint Petersburg International Conference on Integrated Navigation Systems; October 1999, pp. 10-1 - 10-10; In English; See also 20000012172; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

The combined GPS/GLONASS (Global Positioning System/ Global Navigation Satellite System) receiver ASN-2401P has been installed on the manned space ship 'Soyuz-TM28' and was used to obtain experimental data during its flight to the space station 'Mir' in August - November 1998. The ASN-2401P receiver is based on the ASN-22 eighteen-channel C/A-code avionics receiver module: a joint development of Dasa NFS (Germany, Ulm) and RIRT (Russia, St.Petersburg). The ASN-22 receiver module is described in brief. The receiver used in the experiment together with the antenna will become core elements of navigation system of Russian module of International Space Station 'Alpha' and Russian space ships. Raw pseudorange and carrier phase measurements, along with the position, velocity and time (PVT) results have been recorded during the autonomous flight of 'SoyuzTM28', rendezvous operations, as well as during the docked to 'Mir' flight. The receiver installation, space ship attitude orientation modes, receiver control and data recording are described. Analysis of flight data is presented in the paper.

Author

Global Positioning System; Mir Space Station; Soyuz Spacecraft; International Space Station; Space Rendezvous; Glonass; Flight Tests

20000012183 Quebec Univ., Ecole de Technologie Superieure, Montreal, Quebec Canada

NEW TECHNIQUE TO IMPROVE GPS RECEIVER PERFORMANCES BY ACQUISITION AND TRACKING THRESHOLDS REDUCTION

Landry, Rene, Jr., Quebec Univ., Canada; 6th Saint Petersburg International Conference on Integrated Navigation Systems; October 1999, pp. 11-1 - 11-11; In English; See also 20000012172; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

This paper proposes a robust method for threshold's reduction taking into account features both concerning GPS receiver modification and real gain on the performances improvement. This method involves two steps. The aim is to use the strong channels of the GPS (Global Positioning System) receiver which are actually tracking satellites for velocity aiding the other channel trying to acquire or track satellites presenting a low signal over noise ratio due to lower elevation or masking conditions. Second, according to the theory and the characteristics of the digital internal loops of the GPS receiver, the predetection bandwidth is reduced to the lowest value permitted by the velocity aiding accuracy. This technique allows to improve the GPS accuracy and robustness. The paper shows first a large panorama of all potential threshold's reduction techniques both for acquisition and tracking processes. It proposes and identifies the automatic model of a velocity aided loop. Furthermore, to allow the validation of the described tracking threshold reduction, the technique is proposed to be inserted and validated into the new GPS simulator which is a generic digital MATLAB GPS receiver model. This work is intended to be used for space and aeronautical applications.

Author

Applications Programs (Computers); Global Positioning System; Computerized Simulation; Mathematical Models; Autonomy; Target Acquisition

20000012184 Stanford Telecommunications, Inc., Reston, VA USA

ANALYSIS OF TRACKING PERFORMANCE OF A DELAY LOCKED LOOP FOR NEWLY PROPOSED GPS SIGNAL WAVEFORMS

Draganov, Alexandr, Stanford Telecommunications, Inc., USA; Stafford, James, Stanford Telecommunications, Inc., USA; 6th Saint Petersburg International Conference on Integrated Navigation Systems; October 1999, pp. 12-1 - 12-10; In English; See also 20000012172; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

Recently, several new GPS waveforms have been suggested to enhance the GPS signal. This paper presents a comparative theoretical analysis of Delay Locked Loop (DLL) tracking performance for different waveforms in the presence of the ambient white noise, and band-limited, shaped spectrum noise. Incoherent (power) DLL is selected as a baseline design. For the purposes of comparative analysis, gain is treated as an arbitrary parameter and is selected to provide desired (and uniform) dynamic tracking capabilities of the DLL for different waveforms. The dynamic differential equation for the code phase being tracked by the DLL is examined by a means of the Fokker-Planck formulation. The Fokker-Planck equation is a partial differential equation describing the evolution of statistical characteristics of the tracking error. Coefficients for the Fokker-Planck equation are derived analytically for all waveforms under consideration. The tracking performance is linked to eigenvalues and eigenvectors of the Sturm-Liouvile problem for the Fokker-Planck equation. Eigenvalues and eigenvectors are found numerically yielding two major results: the average time to lose lock and the root mean squared (RMS) tracking error. Results for different waveforms and different signal to noise (SNR) ratios are presented. They show superior tracking capabilities for P(Y) and C/A signals as compared to more complicated subcarrier modulated waveforms, if the latter are tracked using a typical 'early squared minus late squared' DLL. Tracking of subcarrier modulated waveforms can be improved substantially if the subcarrier is tracked separately, using a PLL-type

loop. In addition to tracking signals in the presence of the Gaussian white noise, the paper analyzes tracking in the presence of band-limited, shaped spectrum noise (including possible interference from other GPS waveforms) and tracking in the presence of a tone jammer. The quantitative effect of a band-limited noise and of a jammer is mapped to a spectral density of a white Gaussian noise which would cause the same tracking degradation as the band-limited noise and/or jammer under consideration. Thus, for different types of interference, an equivalent white Gaussian noise density is determined, and tracking characteristics can be determined using results previously obtained for the noise case.
Author
Global Positioning System; Waveforms; Ambience; Mathematical Models; Tracking (Position); Random Signals

20000012185 Kayser Threde G.m.b.H., Munich, Germany
RESULTS FROM THE GPS EXPERIMENT ON EQUATOR-S
Lemke, Norbert, Kayser Threde G.m.b.H., Germany; Eissfeller, Bernd, Munich FAF Univ., Germany; Balbach, Oliver, Munich FAF Univ., Germany; Enderle, Werner, Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; Schmidhuber, Michael, Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; 6th Saint Petersburg International Conference on Integrated Navigation Systems; October 1999, pp. 13-1 - 13-9; In English; See also 20000012172; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

An encouraging concept for position determination of geostationary satellites is the use of the Global Positioning System (GPS). Although the geostationary orbit is well beyond the orbits of the GPS Navstar satellites (i.e. 200W km), it is possible to use GPS - as demonstrated with the GPS experiment on board of the German Small Satellite Equator-S. The experiment data have significant impact for the future use of GPS receivers on-board geostationary satellites. In the past, GPS receivers have only been used well below the orbital altitude of the GPS satellites. The reception of GPS signals at greater altitudes has been demonstrated within the Equator-S GPS experiment. As part of this, GPS signals have also been received from the antenna side lobes of the GPS satellites. The maximum altitude where the GPS receiver provided measurements was about 61 000 km.
Author
Global Positioning System; Equators; Geosynchronous Orbits; Navigation Satellites; Satellite Tracking

20000012186 Technische Univ., Dept. of Mathematical Geodesy and Positioning, Delft, Netherlands
A PERMANENT GPS/GLONASS REFERENCE STATION IN THE NETHERLANDS
deJong, C. D., Technische Univ., Netherlands; Jonkman, N. F., Technische Univ., Netherlands; 6th Saint Petersburg International Conference on Integrated Navigation Systems; October 1999, pp. 15-1 - 15-11; In English; See also 20000012172; Original contains color illustrations; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

In The Netherlands research on establishing permanent GPS (Global Positioning System) reference stations was initiated in 1993, resulting in a network of five stations together with a central processing facility. This network, the Active GPS Reference System for The Netherlands (AGRS.NL) is used for a wide variety of high-precision GPS applications. They include positioning, sea-level and subsidence monitoring and land-surveying, but also the determination in near real-time of the water vapor content of the atmosphere. With the development of the Russian Glonass (Global Navigation Satellite System), a second satellite navigation system has become available for similar high-precision applications. The combined use of GPS and Glonass is expected to greatly enhance the availability and reliability of space based navigation systems. In The Netherlands the potential benefits of Glonass were recognized, resulting in a joint research project of the Survey Department of the Ministry of Transportation and Public Works (MD) and Delft University of Technology (DUT), the purpose of which is to gain more insight in the performance of Glonass and in the possibilities of GPS/Glonass integration. As part of the MD/DUT research project, DUT has established a permanent GPS/Glonass reference station, co-located with one of the GPS reference stations of AGRS.NL. The station is used to monitor the integrity of the Glonass system and the quality of the collected observations. To this end, dedicated integrity monitoring software developed at DUT for the AGRS.NL array has been adapted to incorporate Glonass observations. The software is able to detect, identify and adapt outliers and slips in GPS and Glonass observations in real-time. Moreover, as a by product it also allows for the generation of DGPS/DGlonass corrections and ionosphere estimates. In this contribution, a description is given of the GPS/Glonass reference station and the integrity monitoring software that is running at the station. The error detection capabilities of the software are described and demonstrated as well as some of its advanced options like multipath modeling and ionosphere estimation. The contribution will be concluded with a brief outline of future DUT research activities directed towards Glonass and GPS/Glonass integration.
Author
Global Positioning System; Navigation Satellites; Netherlands; Mathematical Models; Applications Programs (Computers); Glonass

20000012187 Bauman Moscow State Technical Univ., Lab. of Inertial Geodetic Systems, Moscow, Russia
INERTIAL NAVIGATION SYSTEMS IN GEODETIC APPLICATION: LIGS EXPERIENCE
Salychev, Oleg S., Bauman Moscow State Technical Univ., Russia; Voronov, Vladimir V., Bauman Moscow State Technical Univ., Russia; Lukianov, Vadim V., Bauman Moscow State Technical Univ., Russia; 6th Saint Petersburg International Conference on Integrated Navigation Systems; October 1999, pp. 16-1 - 16-12; In English; See also 20000012172; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

Different applications of inertial technology to the Geodesy and Geophysics is considered: from precise positioning to airborne gravimetry. Actually, the materials of inertial navigation systems (INS) applications and testing is based on the long time experience got, by the Laboratory of Inertial Navigation Systems (LIGS) at the Bauman Moscow State Technical University in the field of the real-time navigation and inertial geodesy. The wide spectrum of the testing results obtained in the different countries where our equipment was applied is considered and interpreted.
Author
Inertial Navigation; Geodesy; Geophysics; Computer Programs; Mathematical Models

20000012188 National Research Council of Canada, Flight Research Lab., Ottawa, Ontario Canada
LOW COST STRAPDOWN INERTIAL/GPS INTEGRATED NAVIGATION FOR FLIGHT TEST REQUIREMENTS
Leach, Barrie W., National Research Council of Canada, Canada; 6th Saint Petersburg International Conference on Integrated Navigation Systems; October 1999, pp. 17-1 - 17-12; In English; See also 20000012172; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

This paper describes the development of a capability to integrate low cost strapdown IMU (Inertial Measurement Units) data with differential GPS (DGPS) data, in an optimal fashion, using the principles of Kalman filtering and smoothing. The goal is to create a complete strapdown navigator, based on the low cost IMU, by employing an INS/DGPS (Inertial Navigation System/Differential Global Positioning System) Kalman filter in an error state feedback configuration. In this manner, the strapdown IMU's inherently large errors can be corrected in real time to provide a strapdown navigator of sufficient accuracy for all inertial sensing requirements. The raw IMU/DGPS data can also be optimally integrated postflight, using a Kalman filter-smoother, to establish an even more accurate aircraft inertial state time history 'after the fact'.
Author
Inertial Navigation; Global Positioning System; Inertial Platforms; Flight Tests; Computerized Simulation; Mathematical Models

20000012189 Italian Air Force, Research and Flight Test Div., Rome, Italy
HIGH PRECISION DGPS AND DGPS/INS POSITIONING FOR FLIGHT TESTING
Sabatini, Roberto, Italian Air Force, Italy; 6th Saint Petersburg International Conference on Integrated Navigation Systems; October 1999, pp. 18-1 - 18-17; In English; See also 20000012172; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

Historically, test ranges have provided accurate time and space

position information (TSPI) by using laser tracking systems, cinetheodolite systems, tracking radars, and ground-based radio positioning systems. These systems have a variety of limitations. In general, they provide a TSPI solution based on measurements relative to large and costly fixed ground stations. Weather has an adverse effect on many of these systems, and all of them are limited to minimum altitudes or to confined geographic regions. The number of participants each system can support is limited, and correlation with other systems is extremely difficult, if not impossible. These limitations greatly increase instrumentation costs and impose severe constraints on test scenarios. Clearly, a more cost effective TSPI source is needed. The Global Positioning System (GPS) provides a cost effective capability that overcomes nearly all the limitations of existing TSPI sources. GPS is a passive system using satellites which provide a universal and accurate source of real-time position and timing data to correlate mission events. The coverage area is unbounded and the number of users is unlimited. The use of land-based differential GPS (DGPS) reference stations improves accuracy to about one metre for relatively stationary platforms, and to a few metres for high performance military aircraft. Further accuracy enhancement can be obtained by using GPS carrier phase measurements, either in post-processing or in real-time. Accuracy does not degrade at low altitudes above the earth's surface, and loss of navigation solution does not occur as long as the antenna has an open view of the sky. However, DGPS performance in terms of data continuity and accuracy during high dynamic maneuvers, even if sufficient for many tasks, can not cover the entire flight envelope of modem high performance fighter aircraft. Moreover, the update-rate of GPS receivers is too low for many tasks. Currently, the integration of GPS with an inertial navigation system (INS) is considered to be the optimal solution to the above mentioned shortcomings. This combination, in fact, can provide the required update rate and have a higher data continuity and integrity. The other advantages of an INS: low short term drift and low noise, are combined with the advantages of GPS: high position accuracy and no long term drift. Moreover, the combination of an INS with GPS is a natural evolution of existing airborne navigation systems, the majority of which is currently based on an INS, updated by other positioning systems to compensate for the shortcomings of the inertial system.
Author
Flight Tests; Global Positioning System; Inertial Navigation; Applications Programs (Computers); Data Integration; Mathematical Models; Fighter Aircraft

20000012190 Joint Stock Co. Agency for Science and Technology, Saint Petersburg, Russia
STRUCTURES OF INTEGRATED NAVIGATION SYSTEMS BASED ON STRAPDOWN INERTIAL NAVIGATION SYSTEMS (SINS) OF AVERAGE ACCURACY
Tazba, Alexander M., Joint Stock Co. Agency for Science and Technology, Russia; Levi, Yuri V., Joint Stock Co. Agency for Science and Technology, Russia; 6th Saint Petersburg International Conference on Integrated Navigation Systems; October 1999, pp. 19-1 - 19-8; In English; See also 20000012172; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

The possibility of constructing integrated inertial satellite navigation systems for civil aviation aircrafts based on angular velocity meters and accelerometers of average accuracy is considered. The ways of construction of such systems and positive results of construction are shown. Ways of further increasing the navigation system's integratedness level for their upgrading are substantiated. Author
Inertial Navigation; Satellite Navigation Systems; Mathematical Models; Civil Aviation; Strapdown Inertial Guidance

20000012191 Technische Univ., Inst. of Flight Guidance and Control, Brunswick, Germany
HIGH PRECISION INTEGRATED NAVIGATION SYSTEM FOR VEHICLE GUIDANCE
Schaenzer, G., Technische Univ., Germany; 6th Saint Petersburg International Conference on Integrated Navigation Systems; October 1999, pp. 20-1 - 20-9; In English; See also 20000012172; Sponsored in part by Lower Saxony Minister for Science and Culture; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

The task of bringing a vehicle safely to its destination is a problem of which a solution has been sought for generations. The compass has been in use for over 1000 years as a navigation instrument for sea voyages. As a result of high safety requirements in aviation, radio navigation systems such as Loran, Decca, VOR (VHF Omnirange Navigation), DME (Distance Measuring Equipment) were developed and have achieved special significance. The achieved precision ranges from approximately 200m up to 1000m. Inertial Navigation Systems (INS), as a rule, do not attain the degree of precision of radio navigation systems, but can function autonomously, for example during long distance transoceanic flight. INS typically have time dependent errors of about 2 km per hour. It is obvious that a high degree of precision and safety is beneficial to aviation and sea navigation, but is of great interest for military applications as well. High demands for precision and reliability are presently posed by all weather approaches in civil aviation. Accuracy of better than 60 cm on the runway threshold must be demonstrated for so called 'blind landings' (weather conditions corresponding to CAT 111). They are achieved, although at great expense, through the use of Instrument Landing Systems. A modern successor to the ILS, according to a resolution by the International Civil Aviation Organization (ICAO), is to be the Microwave Landing System (MLS) whose introduction has been delayed for technical and commercial reasons. Derived from text
Inertial Navigation; Global Positioning System; Satellite Navigation Systems; Applications Programs (Computers); Civil Aviation; Radio Navigation; Inertial Guidance

20000012192 Ramenskoye Design Co., Ramenskoye, Russia
MONITORING AND ADAPTIVE ROBUST PROTECTION OF THE INTEGRITY OF AIR DATA INERTIAL SATELLITE NAVIGATION SYSTEMS FOR MANEUVERABLE AIRCRAFT
Djandjgava, G. I., Ramenskoye Design Co., Russia; Rogalev, A. P., Ramenskoye Design Co., Russia; Chernodarov, A. V., Ramenskoye Design Co., Russia; 6th Saint Petersburg International Conference on Integrated Navigation Systems; October 1999, pp. 21-1 - 21-10; In English; See also 20000012172; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

This paper is devoted to the problem of maintaining the integrity of navigation systems (NS's) of maneuverable aircraft under real noise environment. The proposed solution of this problem relies on the potentialities of hardware and algorithmic redundancy when constructing the loops for primary and secondary signal processing. Such a redundancy permits one to improve the reliability of estimation of NS state parameters under uncertainty and also to ensure the mutual support of NS's if critical situations occur. Hardware redundancy is assumed to be attained by the integration, into a unified navigation-time space, of air data, inertial, and satellite measuring channels. It is also assumed that algorithmic redundancy is achieved by the integration, into a single information space, of neural-network procedures for adaptive robust signal processing and combined procedures for detecting and counteracting outliers and failures, too. The effectiveness, as applied to integrated NS's, of the algorithms obtained has been confirmed by the results of half-scale modeling. Author
Inertial Navigation; Aircraft Noise; Satellite Navigation Systems; Air Data Systems; Mathematical Models; Aircraft Maneuvers; Computer Program Integrity

20000012193 State Research Center of the Russian Federation-Central Scientific and Research Inst. Elektropribor, Saint Petersburg, Russia
OPTIMAL MAP-MATCHING FOR CAR NAVIGATION SYSTEMS
Dmitriev, S. P., State Research Center of the Russian Federation-Central Scientific and Research Inst. Elektropribor, Russia; Stepanov, O. A., State Research Center of the Russian Federation-Central Scientific and Research Inst. Elektropribor, Russia; Rivkin, B. S., State Research Center of the Russian Federation-Central Scientific and Research Inst. Elektropribor, Russia; Koshaev, D. A., State Research Center of the Russian Federation-Central Scientific and Research Inst. Elektropribor, Russia; Chung, D., Samsung Electronics Co. Ltd., Russia; 6th Saint Petersburg International Conference on Integrated Navigation Systems; October 1999, pp. 22-1 - 22-9; In English; See also 20000012172; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

A statement and a general solution of the problem of determining a car position on a road by using both external measurements (speed, course and coordinates) and maps of roads are suggested and considered within the framework of the Markovian theory of nonlinear filtering. The aim of the problem is to find the most

probable road along which a car is moving and to determine its position to the maximum accuracy. Some algorithms are synthesized and the problem of the potential accuracy analysis is solved. The efficiency of the algorithms developed is tested by using real information about the coordinates, speed and course obtained from a satellite system.
Author
Map Matching Guidance; Mathematical Models; Satellite Navigation Systems; Automobiles; Field Tests

20000012194 DaimlerChrysler Aerospace A.G., Military Aircraft, Munich, Germany
RELIABLE AUTONOMOUS PRECISE INTEGRATED NAVIGATION (RAPIN) FOR PRESENT AND FUTURE AIR-VEHICLES
Koehler, Thomas, DaimlerChrysler Aerospace A.G., Germany; Turnbraegel, Franz, DaimlerChrysler Aerospace A.G., Germany; Lohmiller, W., DaimlerChrysler Aerospace A.G., Germany; Beyer, J., DaimlerChrysler Aerospace A.G., Germany; 6th Saint Petersburg International Conference on Integrated Navigation Systems; October 1999, pp. 23-1 - 23-8; In English; See also 20000012172; Original contains color illustrations; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

RAPIN (Reliable Autonomous Precise Integrated Navigation) is an integrated navigation system designed for safety and precision in onboard autonomous flight management close to the ground. A digital terrain database is used as an additional information source. Integrating 3 physically independent sensors with complementary behavior LINS (Laser Inertial Navigation System), GPS (Global Positioning System) and TRN (Terrain Reference Navigation System) allows RAPIN to isolate and remove sensor errors. A navigation demonstrator was realized in the RAPIN research and technology project and tested in the Transall C 160 test carrier. The flight trials verified functionality and performance under realistic deployment conditions. Evaluation of the flight trials shows that RAPIN is in conformity with the requirements for tactical low-altitude flight management even under conditions of GPS failure. It was also demonstrated that landings could be performed.
Author
Autonomous Navigation; Flight Management Systems; Inertial Navigation; Global Positioning System; Applications Programs (Computers); Computer Program Integrity

20000012196 Technical Univ. of Istanbul, Dept. of Aeronautics and Astronautics Engineering, Turkey
AN INTEGRATED NAVIGATION SYSTEM FOR OFFSHORE PLATFORM COORDINATES SUPERVISION
Hajiyev, C. M., Technical Univ. of Istanbul, Turkey; Caliskan, F., Technical Univ. of Istanbul, Turkey; 6th Saint Petersburg International Conference on Integrated Navigation Systems; October 1999, pp. 26-1 - 26-8; In English; See also 20000012172; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

In this paper, a multichannel Kalman filter design to integrate different measurement systems for offshore platform (OP) coordinates supervision is presented. The complete OP motion is assumed to be composed of the low-frequency motion caused by the wind and undercurrent, and the high frequency motion caused by the sea-way. The mathematical model of the low frequency OP motion is given by the normal differential equations system, and the high-frequency OP motion is represented by the multivariable autoregression model with the sliding mean. The parameter estimation problem for the model of the low-frequency OP motion, on which the in-service control is performed, is solved through two jointly operating Kalman filters: the first one is used for the estimation of the parameters of the low-frequency motion, and the second one is employed for the high frequency one. The parameters of the first filter are automatically adapted to variations of the second filter, i. e. they are adapted to variations of the sea. Two algorithms for the OP motion parameter estimation (parallel and with preliminary data compression) which are employed for several measuring channels data estimation, are developed, and simulated on a computer.
Author
Offshore Platforms; Mathematical Models; Algorithms; Computerized Simulation; Navigation

20000012197 Zhukovsky Air Force Engineering Academy, Zhukovsky, Russia
STEREOSCOPIC NAVIGATION AND OBSERVATION SYSTEMS
Beloglazov, I. N., Zhukovsky Air Force Engineering Academy, Russia; Kazarin, S. N., Zhukovsky Air Force Engineering Academy, Russia; 6th Saint Petersburg International Conference on Integrated Navigation Systems; October 1999, pp. 25-1 - 25-12; In English; See also 20000012172; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

The possibility of obtaining the three-dimensional image of an observed scene has been studied in detail in photogrammetry (stereo-photogrammetry). Besides photography facilities, the shooting can be obtained by other iconic systems such as television and infrared systems, radiometers, radar stations, etc., which substantially extends the photogrammetry field. Television, radar, and other kinds of photogrammetry have appeared. Due to the development of powerful computers, the possibility of digital data processing for various iconic systems on moving objects in real time has appeared. Currently, besides cartography, architecture, and building, the ideas of stereo-photogrammetry are beginning to be applied in systems of stereoscopic computer vision and stereoscopic television systems of future generations. Stereo-photogrammetry has wide potential in navigation. The problem of estimating the location and orientation in three dimensional space of a mobile object equipped with an iconic system acquiring two-dimensional images is solved. The possibility of using these systems for a vision system of a mobile robot is stressed. The ideas of stereoscopic systems are applied in aircraft navigation. In particular, Innovative Configuration (USA) is developing a navigational three-dimensional video system for helicopters to provide safety during low-attitude flights (for instance, over forests). This paper is aimed at the development and generalization of theoretical results. We derive equations of observation for the use of both a stereo image and a sequence of stereo images, and synthesize optimal rigid and searching algorithms of data processing in stereoscopic navigation systems, study the accuracy of aircraft positioning and determination of the aircraft velocity and orientation, synthesize an algorithm of optimal data processing in combined stereoscopic navigation systems that joins the idea of search and optimal filtration.
Derived from text
Photogrammetry; Stereophotography; Navigation; Mathematical Models; Three Dimensional Models; Air Navigation; Computerized Simulation

20000037889 Remote Services Ltd., Northwood, UK
AIRSPACE POLICY AND AIR TRAFFIC MANAGEMENT
Clot, Andre J., Remote Services Ltd., UK; Development and Operation of UAVs for Military and Civil Applications; April 2000, pp. 2A-1 - 2A-26; In English; See also 20000037887; Copyright Waived; Avail: CASI; A03, Hardcopy

The world of manned aviation has been the predominant aerial activity in the skies for the 20th century. The fundamental principle by which the infrastructure and institutional arrangements have been predicated is that there is a man in the loop in the air (pilots) and on the ground (air traffic controllers). With the advent of extremely capable Unmanned Aerial Vehicle (UAV) systems, this will no longer be the case and many assumptions about how aircraft are designed, developed and operated will be challenged. However, in the 21st century this will be an evolutionary process and the organisations that will take it forward are already in place today, to begin the task of providing the necessary frameworks within which UAV systems will co-exist alongside manned aircraft. The challenges for these organisations include legislation and regulation, airspace policy, air traffic management, airworthiness, certification, communications, command and control. This lecture covers issues relating to airspace policy and air traffic management aspects.
Author
Pilotless Aircraft; Command And Control; Law (Jurisprudence); Air Traffic Control; Certification; Policies

20000047449 Research and Technology Organization, Systems Concepts and Integration Panel, Neuilly-sur-Seine, France
FLIGHT TESTING OF RADIO NAVIGATION SYSTEMS *[LES ESSAIS EN VOL DES SYSTEMES DE RADIONAVIGATION]*
April 2000; 83p; In English; CD-ROM contains the entire document presented in PDF format; A Bit Map image of the CD label is also provided

Report No.(s): RTO-AG-300-Vol-18; AC/323(SCI)TP/26-Vol-18; ISBN 92-837-1039-8; Copyright Waived; Avail: CASI; A05, Hardcopy; A01, Microfiche; C01, CD-ROM

Civil as well as military aviation relies on a number of radio navigation systems including satellite systems in space. As new systems are developed extensive flight testing is needed to ensure that the design parameters are met. The approval of every new installation is dependent on flight tests. Moreover, all installations require flight inspection in well-defined time periods. The development and application of cost effective flight test techniques and instrumentation systems including the test aircraft are presented. Room is given also to the adverse effects of radio wave propagation like multipath.

Author

Flight Tests; Radio Navigation; Navigation Aids; Inspection

20000108809 Raytheon Co., Alpharetta, GA USA

INS/GPS FOR STRIKE WARFARE BEYOND THE YEAR 2000

Licata, William H., Raytheon Co., USA; Technologies for Future Precision Strike Missile Systems; September 2000, pp. 10-1 - 10-8; In English; See also 20000108801; Copyright Waived; Avail: CASI; A02, Hardcopy

This paper presents a review of Inertial Navigation Systems (INS) and the Global Positioning System (GPS) as a key technology for Strike Warfare beyond the Year 2000. The paper reviews the functionality that INS/GPS provides the Missile Guidance, Navigation and Control (GNC) designer plus the requirements associated with this functionality. Existing systems on the market are reviewed and new systems that can be expected to enter the market in the 2000 to 2010 time frame are discussed. System issues associated with the use of this hardware and trends in system integration methods are reviewed. The paper concludes with a discussion of the likely future uses of INS/GPS in precision strike missiles.

Author

Global Positioning System; Inertial Navigation; Missile Control; Missiles; Automatic Flight Control; Homing Devices; Trajectory Planning; Warfare; Target Recognition

20010082332 Ministry of Defence, Inst. of Military Technology, Budapest, Hungary

COTS IN OUR AIR CONTROL SYSTEM

Szekely, Bela, Ministry of Defence, Hungary; Strategies to Mitigate Obsolescence in Defense Systems Using Commercial Components; June 2001, pp. 6-1 - 6-5; In English; See also 20010082326; Original contains color illustrations; Copyright Waived; Avail: CASI; A01, Hardcopy

A huge international project was launched in 1997 in Hungary: setting up an air control and sovereignty nationwide system based on former Soviet radars and American air sovereignty operations center (ASOC). The deadline was extremely short and the available funds low. The main strategy of the project was to use modular elements and commercial components as much as possible. That is why we decided using PC-s (dual Pentium II class), Windows NT 4.0 operating system and Visual C++ developer system. Some part of hardware were developed using digital signal processors (TEXAS type). Our specialists and American colleagues worked hard and the American-made ASOC center and the Hungarian information system were used for military service in the fourth quarter of 1998. The system transmitted the radar (military and civil, primer and secondary) information automatically to ASOC in real time.

Author

International Cooperation; Air Traffic Control; Sovereignty

05
AIRCRAFT DESIGN, TESTING AND PERFORMANCE

19990026323 British Aerospace Airbus Ltd., Bristol, UK

THE EFFECT OF CORROSION ON THE STRUCTURAL INTEGRITY OF COMMERCIAL AIRCRAFT STRUCTURE

Worsfold, Martin, British Aerospace Airbus Ltd., UK; Fatigue in the Presence of Corrosion; March 1999; 10p; In English; See also 19990026320; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

The purpose of this paper is to discuss the effect of corrosion on the structural integrity of commercial aircraft wing structure. Data is presented for fatigue specimens tested with corrosion damage and following a spotface repair operation. The data demonstrates that failure initiates earlier from specimens with corrosion damage, when compared to corrosion free specimens, and that the reduction in fatigue life was due to a shortened crack initiation period.

Author

Corrosion; Structural Failure; Aircraft Maintenance; Wings; Fatigue Life; Commercial Aircraft; Crack Initiation; Aircraft Reliability

19990026324 Divisione Aerea Studi Ricerche e Sperimentazioni, Chemical-Technological Dept., Pratica di Mare, Italy

AGING AIRCRAFT: IN SERVICE EXPERIENCE ON MB-326

Colavita, Mario, Divisione Aerea Studi Ricerche e Sperimentazioni, Italy; Dati, Enrico, Divisione Aerea Studi Ricerche e Sperimentazioni, Italy; Trivisonno, Giovanni, Divisione Aerea Studi Ricerche e Sperimentazioni, Italy; Fatigue in the Presence of Corrosion; March 1999; 6p; In English; See also 19990026320; Original contains color illustrations; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

In 1996 a European research project on Structure Maintenance of Aging Aircraft (SMAAC), where a consistent number of partners decided to cooperate in order to offer an answer to this problem was begun. The first purpose of the research project was joining the In-Service Experiences that allow to relate all structural and chemical degradation induced by corrosion to the potential interactions with fatigue. Italian Air Force (IAF) and AerMacchi decided to carry out a tear-down inspection on a 30 year old Macchi MB-326, a small trainer aircraft, having 4685 flight hours with respect to 5979 safe life hours. For this purpose the chosen test articles were fuselage center section, tailplane, wings, and front fuselage. The first two of them were investigated at the Air Force laboratories and the other ones at the AerMacchi research department. Particular attention was focused on the components subjected to the high stress and potential corrosion in areas not accessible during routine servicing.

Author

Fatigue (Materials); Corrosion; Structural Failure; Aircraft Reliability; Aircraft Maintenance; Aircraft Structures; Stress Corrosion; Inspection; Service Life

19990026326 Patras Univ., Lab. of Technology and Strength of Materials, Greece

THE EFFECT OF EXISTING CORROSION ON THE STRUCTURAL INTEGRITY OF AGING AIRCRAFT

Pantelakis, S. G., Patras Univ., Greece; Kermanidis, T. B., Patras Univ., Greece; Daglaras, P. G., Patras Univ., Greece; Apostolopoulos, C. A., Patras Univ., Greece; Fatigue in the Presence of Corrosion; March 1999; 14p; In English; See also 19990026320; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

Investigation on effects of existing corrosion on the structural integrity of aging aircraft structures was made. The study included characterization of the tensile behaviour as well as determination of the fatigue and fatigue crack growth behaviour of structural aircraft aluminium alloys following corrosion exposure. The investigation of the tensile behaviour following corrosion exposure was performed on the aluminium alloys 2024, 8090, 2091, and 6013. The materials were exposed to five different accelerated laboratory corrosion tests; alloy 2024 T351 was also subjected to out-door exposure. Evaluation has shown an appreciable decrease of yield and ultimate tensile stress caused by corrosion attack on the materials surface layers. In addition, a dramatic volumetric embrittlement of the corroded materials was observed; it has been associated to hydrogen penetration and absorption. The influence of existing corrosion on fatigue life and fatigue crack growth of 2024 alloy was evaluated as well. Obtained S-N curves are confirming the expected decrease of fatigue life following corrosion. Fatigue crack growth tests performed for several R-ratios have shown that crack growth rates are practically not practically influenced by existing corrosion, yet, this result should not be misinterpreted as an insignificance of existing corrosion for the damage tolerance behaviour of the structure.

Author

Corrosion; Structural Failure; Aircraft Structures; Aluminum Alloys; Corrosion Tests; Crack Propagation; Hydrogen Embrittlement; Fatigue Life; Tensile Stress

19990026333 Air Force Research Lab., Robins AFB, GA USA
CORROSION IN USAF AGING AIRCRAFT FLEETS
Kinzie, Richard, Air Force Research Lab., USA; Cooke, Garth, Air Force Research Lab., USA; Fatigue in the Presence of Corrosion; March 1999; 12p; In English; See also 19990026320; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

This paper summarizes the results of research projects undertaken by the USA Air Force Corrosion Program Office within the past year and a half. It reflects the cooperative results obtained from a team of almost 50 researchers that represented over a dozen different corporate entities. All were marching to a tune composed and conducted by the program office. This paper covers work associated with environmental modeling, development of a revised corrosion maintenance concept, and development of a corrosion growth model that can be used by depot engineers to improve the maintenance of their aircraft.
Author
Fatigue (Materials); Military Aircraft; Corrosion; Structural Failure; Aircraft Reliability; Aircraft Maintenance

19990026338 Analytical Processes/Engineered Solutions, Inc., Saint Louis, MO USA
INTEGRATING REAL TIME AGE DEGRADATION INTO THE STRUCTURAL INTEGRITY PROCESS
Brooks, Craig L., Analytical Processes/Engineered Solutions, Inc., USA; Simpson, David, Institute for Aerospace Research, Canada; Fatigue in the Presence of Corrosion; March 1999; 13p; In English; See also 19990026320; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

The principal focus of this paper is to describe a process for incorporating the 'age degradation' aspects of aircraft into the existing infrastructure of the design, manufacturing, and maintenance of aircraft systems. The tailoring of the structural integrity process enables the industry and the user communities to meet the needs, opportunities, and challenges being presented by the Aging Aircraft Fleet. The economic and safety impact of the continued use of some aircraft necessitates an enhancement to the existing system. This paper describes the rationale, approaches, and techniques to evolve the structural integrity process to include the effects of corrosion, sustained stress corrosion cracking, and other age related degradation effects. A viable method of utilizing the proposed approach is presented in a fashion to realize benefits throughout the full life cycle of aircraft systems.
Author
Fatigue (Materials); Corrosion; Structural Failure; Aircraft Maintenance; Aging (Metallurgy); Degradation; Real Time Operation; Stress Corrosion Cracking; Manufacturing

19990032449 Research and Technology Organization, Systems Concepts and Integration Panel, Neuilly-sur-Seine France
SYSTEM IDENTIFICATION FOR INTEGRATED AIRCRAFT DEVELOPMENT AND FLIGHT TESTING *[L'IDENTIFICATION DES SYSTEMES POUR LE DEVELOPPEMENT INTEGRE DES AERONEFS ET DES ESSAIS EN VOL]*
System Identification for Integrated Aircraft Development and Flight Testing; March 1999; 412p; In English; 5-7 May 1998, Madrid, Spain; See also 19990032450 through 19990032478; Original contains color illustrations
Report No.(s): RTO-MP-11; AC/323(SCI)TP/7; ISBN 92-837-0006-6; Copyright Waived; Avail: CASI; A18, Hardcopy; A04, Microfiche

The NATO RTO symposium focused on the use of system identification as a 'technology integrator'. The symposium was organized in seven sessions covering an overview of recent aircraft programs, identification methodologies, flight test techniques, fixed-wing applications, rotary-wing applications, special vehicle applications (including UAVS) and a session comprising short papers covering 'up-to-the-minute' flight test results. A final session presented prepared remarks from experts and concluded with an open discussion format to consider the key lessons learned in the application of system identification, and areas of needed future work.
Author
System Identification; Aircraft Design; Conferences; Flight Tests; Systems Engineering; Aerodynamics; Parameter Identification

19990032450 Boeing Co., Long Beach, CA USA
AN AIRCRAFT MANUFACTURER'S VIEW OF PARAMETER IDENTIFICATION
Hodgkinson, John, Boeing Co., USA; Boland, Joseph R., Boeing Co., USA; Brandt, Meredith Q., Boeing Co., USA; Lavretsky, Eugene, Boeing Co., USA; Rossitto, Kenneth F., Boeing Co., USA; Stephens, A. Thomas, Boeing Co., USA; Stevenson, Scott W., Boeing Co., USA; Thompson, Thomas L., Boeing Co., USA; System Identification for Integrated Aircraft Development and Flight Testing; March 1999, pp. 1-1 - 1-24; In English; See also 19990032449; Original contains color illustrations; Copyright Waived; Avail: CASI; A03, Hardcopy; A04, Microfiche

Boeing adopts an eclectic approach to parameter identification methods. Time-domain methods for stability and control parameter estimation are used alongside frequency-domain methods which are chiefly used for determining lumped flying qualities parameters. Example applications described include use of identification to develop training simulators for transport aircraft, determining parameters and sensor corrections for fighter/attack aircraft, reconstructing an event for which partial data were available, determining the flying qualities changes due to helicopter modifications, and validating the dynamics of an in-flight simulator.
Author
Parameter Identification; Boeing Aircraft; Aircraft Design; Aircraft Stability; Aircraft Control; Flight Characteristics; Systems Engineering; Time Domain Analysis; Frequency Domain Analysis

19990032451 Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Inst. fuer Flugmechanik, Brunswick, Germany
THE ROLE OF SYSTEM IDENTIFICATION FOR FLIGHT VEHICLE APPLICATIONS: REVISITED
Hamel, P. G., Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; Jategaonkar, R. V., Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; System Identification for Integrated Aircraft Development and Flight Testing; March 1999, pp. 2-1 - 2-12; In English; See also 19990032449; Copyright Waived; Avail: CASI; A03, Hardcopy; A04, Microfiche

During the last few decades system identification methodology has been extensively used for flight vehicle modeling. This paper provides an overview of the basic methodology, highlighting the classical approaches and indicating a few current trends. Successful application of advanced aircraft parameter estimation methods has been demonstrated on a few challenging examples such as determination of aerodynamic effects of secondary importance, identification of highly augmented unstable or flexible aircraft, and high bandwidth rotorcraft modeling. The selected examples demonstrate that the system identification methods have reached a maturity level that makes them a powerful and indispensable tool to support not only research but also the industry activities in various key areas such as model validation, handling qualities evaluation, control law design, and flight vehicle design. Thus, it contributes significantly to risk and cost reduction in the optimal deployment of existing aircraft and in the development of new generation flight vehicles.
Author
System Identification; Aerodynamics; Control Systems Design; Systems Engineering; Control Theory

19990032454 Kohlman Systems Research, Inc., Lawrence, KS USA
DEVELOPING AERIAL REFUELING SIMULATION MODELS FROM FLIGHT TEST DATA USING ALTERNATIVE PID METHODS
Ryan, George Wesley, III, Kohlman Systems Research, Inc., USA; Platz, Stewart J., Kohlman Systems Research, Inc., USA; System Identification for Integrated Aircraft Development and Flight Testing; March 1999, pp. 5-1 - 5-10; In English; See also 19990032449; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

To improve existing aerial refueling training devices, a flight test program was completed for several tanker/receiver pairs for the USA Air Force Air Mobility Command, by Kohlman Systems Research (KSR) and SIMTEC, Inc. These flight tests were designed to record accurate quantitative measurements of the aerodynamic changes and random turbulence acting on both the tanker and receiver during refueling, including accurate real-time relative position measurements of the aircraft. Because the aerial refueling environment is a quasi-steady state environment, flight test data reduction presented some unique problems. The lack of strong forcing function relation-

ships in the data prohibited traditional parameter identification algorithms from working efficiently. Two separate alternative PID methods were developed during the production of an aerial refueling simulation of a C-141B receiver and a KC-135R tanker. The first was designed to identify the large aerodynamic changes associated with refueling. The second was designed to identify the random turbulence associated with the tanker flow field. This paper presents the results of the two methods. The first method is based on trimming the six equations of motion to match the simulation and flight test data. Aerial refueling coefficient deltas and a down-wash term identified from the data as a function of relative position were used to account for the large aerodynamic influences present. The second parameter estimation method was used to identify coefficients from recorded acceleration data. These coefficients were used in a random turbulence model to reproduce the power spectrum of the random turbulence associated with the aerial refueling environment. The end result is a simulation capable of reproducing the response of both aircraft during aerial refueling within tolerances similar to those used for single aircraft training device acceptance.
Author
Air To Air Refueling; Parameter Identification; Flight Simulation; Flight Tests; Motion Simulation; Real Time Operation

19990032455 NASA Langley Research Center, Hampton, VA USA
ADVANCES IN EXPERIMENT DESIGN FOR HIGH PERFORMANCE AIRCRAFT
Morelli, Eugene A., NASA Langley Research Center, USA; System Identification for Integrated Aircraft Development and Flight Testing; March 1999, pp. 8-1 - 8-17; In English; See also 19990032449; Copyright Waived; Avail: CASI; A03, Hardcopy; A04, Microfiche

A general overview and summary of recent advances in experiment design for high performance aircraft is presented, along with results from flight tests. General theoretical background is included, with some discussion of various approaches to maneuver design. Flight test examples from the F-18 High Alpha Research Vehicle (HARV) are used to illustrate applications of the theory. Input forms are compared using Cramer-Rao bounds for the standard errors of estimated model parameters. Directions for future research in experiment design for high performance aircraft are identified.
Author
Aircraft Design; Aircraft Maneuvers; Parameter Identification; Control Systems Design; Systems Engineering

19990032456 British Aerospace Public Ltd. Co., Military Aircraft and Aerostructures, Preston, UK
VALIDATION OF FCS STRUCTURAL COUPLING STABILITY CHARACTERISTICS THROUGH IN-FLIGHT EXCITATION
Caldwell, Brian, British Aerospace Public Ltd. Co., UK; Felton, Richard, British Aerospace Public Ltd. Co., UK; System Identification for Integrated Aircraft Development and Flight Testing; March 1999, pp. 9-1 - 9-10; In English; See also 19990032449; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

The Paper will outline the background to the Structural Coupling 'problem', and the motivation for the development of the in-flight excitation system, analysis methodologies and tools for the Eurofighter project. The influence of the flight clearance requirements on the choice of a frequency domain approach to system identification and hence the system design will be noted. In this application, accuracy and reliability of the structural response phase measurement is of prime importance, and it has been necessary to understand every detail of the system time delays and dynamics interposed between the recorded input and output signals and the corresponding actual parameters, such that these effects can be modelled, and a true representation of in-flight flexible aircraft dynamics obtained. The process of building the required models is described, illustrated with example results from ground and flight tests. The paper will recommend further development and integrated design of the excitation and analysis methods to ensure full value is obtained from the costly flight test campaign.
Author
System Identification; Systems Engineering; Flight Characteristics; Flight Control; Aerodynamic Characteristics; Excitation; Structural Stability; Frequency Domain Analysis

19990032457 NASA Ames Research Center, Moffett Field, CA USA
FLIGHT-TIME IDENTIFICATION OF A UH-60A HELICOPTER AND SLUNG LOAD
Cicolani, Luigi S., NASA Ames Research Center, USA; McCoy, Allen H., Naval Postgraduate School, USA; Tischler, Mark B., Army Aviation and Missile Command, USA; Tucker, George E., NASA Ames Research Center, USA; Gatenio, Pinhas, Israel Flight Test Center, Israel; Marmar, Dani, Israel Flight Test Center, Israel; System Identification for Integrated Aircraft Development and Flight Testing; March 1999, pp. 10-1 - 10-18; In English; See also 19990032449; Copyright Waived; Avail: CASI; A03, Hardcopy; A04, Microfiche

This paper describes a flight test demonstration of a system for identification of the stability and handling qualities parameters of a helicopter-slung load configuration simultaneously with flight testing, and the results obtained. Tests were conducted with a UH-60A Black Hawk at speeds from hover to 80 kts. The principal test load was an instrumented 8 x 6 x 6 ft cargo container. The identification used frequency domain analysis in the frequency range to 2 Hz, and focussed on the longitudinal and lateral control axes since these are the axes most affected by the load pendulum modes in the frequency range of interest for handling qualities. Results were computed for stability margins, handling qualities parameters and load pendulum stability. The computations took an average of 4 minutes before clearing the aircraft to the next test point. Important reductions in handling qualities were computed in some cases, depending on control axis and load-sling combinations. A database, including load dynamics measurements, was accumulated for subsequent simulation development and validation.
Author
System Identification; Flight Tests; Longitudinal Control; Lateral Control; Loads (Forces); Uh-60a Helicopter; Helicopter Control; Frequency Domain Analysis

19990032458 Science Applications International Corp., California, MD USA
AIRCRAFT SYSTEM IDENTIFICATION USING INTEGRATED SOFTWARE TOOLS
Linse, Dennis J., Science Applications International Corp., USA; System Identification for Integrated Aircraft Development and Flight Testing; March 1999, pp. 11-1 - 11-12; In English; See also 19990032449; Copyright Waived; Avail: CASI; A03, Hardcopy; A04, Microfiche

System identification is a complicated, multi-step process requiring considerable expertise to perform. In a traditional flight test program, the elapsed time from flying the aircraft and gathering data until the simulation is updated can be months or even years. The primary reasons behind the long times between flight test and simulation update are the labor-intensive processes of data processing and system identification. Too much time is spent manipulating data and models to the format needed by the disparate programs. The Integrated Data Evaluation and Analysis System (IDEAS) gathers existing software into a distributed client/server architecture that integrates all of the tools required to process flight test data. Using consistent data handling routines and a networked communication scheme, IDEAS can distribute tasks among heterogeneous processors while maintaining an integrated working environment. Tools are available for data preprocessing, filtering, consistency checking, aircraft simulation, equation error, and output error identification as well as communication paths to other existing programs such as frequency domain identification routines. An innovative modeling technique provides uniform access to complex, nonlinear model representations. A single, intuitive description of the identification model is processed by each of the different system identification methods with no recoding or rehosting required. As a demonstration of the capabilities of the integrated system, an analysis of flight test data from a twin turbofan military aircraft is conducted. The aerodynamic and engine models of the current operational flight trainer (OFT) are hosted under the IDEAS framework. Using both equation error and output error techniques, the simulation models are updated using the gathered flight data and validated against independent data. Where possible, nonlinear increments are added to augment the aerodynamics and engines to best match the available data. The

updated simulation shows significant improvement in fidelity of the OFT across the flight envelope.
Author
System Identification; Computer Programs; Data Processing; Flight Tests; Flight Training; Data Simulation; Flight Characteristics; Parameter Identification

19990032459 Alenia, Flight Mechanics Group, Turin, Italy
RECENT EXPERIENCES ON AERODYNAMIC PARAMETER IDENTIFICATION FOR EUROFIGHTER AT ALENIA, BRITISH AEROSPACE, CASA, AND DAIMLER-BENZ AEROSPACE
Bava, Renzo, Alenia, Italy; Hoare, Graham T., British Aerospace Public Ltd. Co., UK; Garcia-Mesuro, Gabriel, Construcciones Aeronauticas S.A., Spain; Oelker, Hans-Christoph, Daimler-Benz Aerospace A.G., Germany; System Identification for Integrated Aircraft Development and Flight Testing; March 1999, pp. 12-1 - 12-11; In English; See also 19990032449; Copyright Waived; Avail: CASI; A03, Hardcopy; A04, Microfiche

EUROFIGHTER, a very agile configuration, which incorporates a high level of inhernet longitudinal instability, will be the new fighter aircraft for the airforces of Italy, UK, Spain, and Germany in the next century. It is being developed jointly by industrial partners of these four nations (Alenia, British Aerospace, Construcciones Aeronauticas S.A., and Daimler-Benz Aerospace). For flight test evaluation of the aerodynamic properties of this aircraft, four different partners confidence has to be established in different methods as well as in comparison between results of different development aircraft. The present paper gives an overview of company specific aerodynamic parameter identification methods. All methods are based on well known theories. Each method, though, incorporates some specific tailoring in order to cope with the characteristics of the basically unstable airframe. Results are given for four principal examples. At first a problem of the aircraft's weathercock stability is discussed. Discrepancies could be confirmed with all methods on different aircraft. The procedure of correcting the dataset is described and illustrated. The second example deals with the twin-seater. Certain increments representing the twin-seater could not be verified in flight test, it is shown how and why they are omitted. Presentation of time history matching illustrates the capabilities of all methods to deal with large perturbation manoeuvres. Finally identifying and reducing tolerances of the dataset leads to an improved flight clearance.
Author
Parameter Identification; Aircraft Design; Flight Tests; Fighter Aircraft; Aerodynamic Characteristics

19990032460 Boeing Co., Seattle, WA USA
A PROCESS FOR MODEL IDENTIFICATION AND VALIDATION OF DYNAMICAL EQUATIONS FOR A FLEXIBLE TRANSPORT AIRCRAFT
Najmabadi, Kioumars, Boeing Co., USA; Fritchman, Bruce, Boeing Co., USA; Tran, Chuong, Boeing Co., USA; System Identification for Integrated Aircraft Development and Flight Testing; March 1999, pp. 13-1 - 13-13; In English; See also 19990032449; Copyright Waived; Avail: CASI; A03, Hardcopy; A04, Microfiche

This paper introduces a process for identification and validation of a single-input/multi-output model for a flexible aircraft based on in-flight control-surface frequency sweeps. This model is used to develop a compensator for active control of aircraft structural modes. The output of the system contains parameters used in the controller design cost function and those used as the feedback signals modified to include appropriate system time delays. The identification method parameterizes the system as a partial fraction expansion and solves a weighted, non-linear least square problem to determine the numerator and denominator coefficients. The initial values of the denominator coefficients are determined based on the higher order aeroelastic model. Once the initial values for the denominator coefficients are known, the initial values for the numerator terms are obtained by the linear least square technique. Two approaches are employed to prove the fidelity of the model for control law design. The first method uses the output signals of the model to provide a closed-loop description of the system for which an in-flight response characteristics exists. Comparison of the in-flight response characteristics with those of the model provides the confidence for the fidelity of the identified model. The second approach utilizes a newly developed compensator and compares the frequency response characteristics of the closed-loop system based on the in-flight sweep data and those based on the model. The closeness between the two frequency responses is treated as a measure of the fidelity of the model. An example of this process for identification and validation of a model for the lateral motion of a commercial transport aircraft is presented.
Author
Parameter Identification; Aircraft Design; Transport Aircraft; Aircraft Control; Active Control; Aircraft Models; Control Theory; Time Domain Analysis

19990032462 National Aerospace Lab., Amsterdam, Netherlands
IN-FLIGHT MODEL IDENTIFICATION RESEARCH AIMED AT DEVELOPING A FLIGHT SIMULATOR MODEL
Breeman, J. H., National Aerospace Lab., Netherlands; Kannemans, H., National Aerospace Lab., Netherlands; Laban, M., National Aerospace Lab., Netherlands; System Identification for Integrated Aircraft Development and Flight Testing; March 1999, pp. 15-1 - 15-12; In English; See also 19990032449; Copyright Waived; Avail: CASI; A03, Hardcopy; A04, Microfiche

In the last decade NLR and Delft University of Technology have conducted an cooperative research program using the Swearingen Metro II laboratory aircraft. Topics studied in this program are a/o instrumentation techniques, flight test techniques and the modeling of aerodynamics, engine thrust, and flight controls. As one of the topics it was decided to investigate the feasibility of in-flight on-line aerodynamic model identification. This paper summarizes the main results of the on-line identification project and then goes on to describe the following off-line analysis, which should lead to a complete flight simulator model for the Metro.
Author
Parameter Identification; Mathematical Models; Flight Tests; Aircraft Models; Flight Simulators; Flight Control; Aerodynamics; In-Flight Monitoring

19990032464 Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Inst. fuer Flugmechanik, Brunswick, Germany
IDENTIFICATION OF AIRCRAFT STALL BEHAVIOR FROM FLIGHT TEST DATA
Fischenberg, D., Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; Jategaokar, R. V., Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; System Identification for Integrated Aircraft Development and Flight Testing; March 1999, pp. 17-1 - 17-8; In English; See also 19990032449; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

An unsteady 5-DoF aerodynamic model for flow separation and stall is presented. The model formulates lift, drag, and the moments in pitch, roll, and yaw as a function of an internal state, namely the position of the flow separation point along the wing chord. In a quasi-steady case, this position is described as a function of the angle of attack and its rate of change, whereas in a transient case it is described in a state-space form using a first order differential equation. Using airfoil wind tunnel data, the plausibility of the model structure is discussed. In a second step, the parameters of the quasi steady and the transient model are identified for two different aircraft using stall flight test data. Validation plots demonstrate the model accuracy and it can be seen clearly that there are considerable unsteady effects at high angles of attack where flow separation occurs, which cannot be described properly using flight mechanic models for attached flow.
Author
Parameter Identification; Aerodynamic Stalling; Boundary Layer Separation; Aircraft Models; Separated Flow; Unsteady Aerodynamics

19990032466 Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Inst. of Flight Mechanics, Brunswick, Germany
AERODYNAMIC MODEL EXTENSION AND VALIDATION OF A THRUST VECTORED DELTA-CANARD CONFIGURATION
Friehmelt, Holger, Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; System Identification for Integrated Aircraft Development and Flight Testing; March 1999, pp. 19-1 - 19-10; In English; See also 19990032449; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

Due to their advantages in aerodynamic characteristics, delta-canard configurations have experienced growing interest and have been realized in various recent aircraft designs. In addition, thrust vectoring has emerged as an efficient means of providing control

power throughout the entire flight envelope. Aerodynamic modeling and identification of parameters for this kind of configurations have usually been restricted to the constant and linear terms in a Taylor series approximation of the force and moment coefficients. These modeling approaches are straight-forward and easy to handle in parameter identification processes but sometimes lack physical understanding of the flow phenomena encountered on delta-canard configuration with thrust vectoring system, although sometimes only of secondary importance, have been omitted completely so far. The present work postulates new extended models which include non-linear and higher order terms in order to better model thrust vector characteristics. By looking at the flow phenomena involved, model formulations are introduced which can be explained and justified by the physical understanding.
Author
Flight Control; Parameter Identification; Thrust Vector Control; Canard Configurations; Mathematical Models; Aerodynamic Characteristics

19990032467 York Univ., Dept. of Electronics, UK
TIME DOMAIN IDENTIFICATION OF HELICOPTERS: A NEW PERSPECTIVE
Clarke, T., York Univ., UK; System Identification for Integrated Aircraft Development and Flight Testing; March 1999, pp. 21-1 - 21-9; In English; See also 19990032449
Contract(s)/Grant(s): EPSRC-GR/H80989; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

The time-domain, observer-Kalman filter/eigensystem realization algorithm is successfully applied to the problem of generating a minimal state space model realization from a non-linear Lynx helicopter model. A linear realization is generated which gives a better representation of the non-linear model than that obtained using small perturbation linearization methods. The approach can be used to extract an unstable model from the flight data of a closed-loop stabilised system, even when the feedback dynamics are not precisely known.
Author
Feedback Control; Helicopters; System Identification; Mathematical Models; Algorithms; Time Domain Analysis

19990032468 Centre d'Etudes et de Recherches, Flight Systems and Dynamics Dept., Toulouse, France
IDENTIFICATION OF THE FLIGHT MECHANICS MODEL OF A LOW-SPEED HELICOPTER *[IDENTIFICATION DU MODELE DE MECANIQUE DU VOL D'UN HELICOPTERE AUX BASSES VITESSES]*
Gimonet, B., Centre d'Etudes et de Recherches, France; System Identification for Integrated Aircraft Development and Flight Testing; March 1999, pp. 22-1 - 22-8; In French; See also 19990032449; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

The Dauphin 6075, in service at the Flight Trials Center (CFV), supports many flight trials under contract to French Official Services (SPAe). This experimental device has been used in DLR/ONERA collaboration on the Smart Helicopter concept for modeling of the low-speed helicopter. This text describes the work undertaken in order to identify a linear model. Preliminary work on selection of valid trials and on the choice of model structure is carried out. The need to introduce the first beating harmonic into the model and, for later work, non-linear terms, is discussed. A traditional technique for minimizing output error, with selection of significant parameters, working within the frequency domain, provides an assessment of the principal stability and command derivatives. A comparison of results obtained with models including 6 or 9 degrees of freedom is presented.
Transl. by Schreiber
Parameter Identification; Stability Derivatives; Mathematical Models; Helicopter Design

19990032469 Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Inst. fuer Flugmechanik, Brunswick, Germany
NONLINEAR ROTORCRAFT MODELING AND IDENTIFICATION
Rohlfs, M., Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; vonGruenhagen, W., Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; Kaletka, J., Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; System Identification for Integrated Aircraft Development and Flight Testing; March 1999, pp. 23-1 - 23-13; In English; See also 19990032449; Copyright Waived; Avail: CASI; A03, Hardcopy; A04, Microfiche

Since regulations for the evaluation of helicopter flight simulators were published in the Advisory Circular 120-63 (AC 120-63) of the Federal Aviation Administration, the need of increasing the simulation fidelity of the helicopter mathematical models becomes more and more relevant to meet the new more restricted requirements. In the Institute of Flight Mechanics mainly two approaches are used to develop helicopter mathematical models. First, linear derivative models are identified from flight test data. The second approach uses detailed vehicle characteristics for the development of a nonlinear helicopter simulation program. The paper describes the two helicopter mathematical modeling approaches and discusses their advantages and disadvantages. Finally, a third approach is introduced, which combines the advantages of both, the linear identified models and the nonlinear generically derived models. Results from all three modeling approaches are presented in both, the time and frequency domain. They are discussed with respect to some selected requirements given in the new FAA advisory circular on helicopter simulator qualification AC 120-63. Finally, conclusions are made and an outlook of future activities is given.
Author
Mathematical Models; Helicopters; Simulation; Parameter Identification

19990032470 Institute for Aerospace Research, Flight Research Lab., Ottawa, Ontario Canada
THE INCLUSION OF HIGHER-ORDER ROTOR DYNAMICS TO IMPROVE THE DYNAMIC MODEL OF A SINGLE ROTOR HELICOPTER IN HOVER
Hui, Kenneth, Institute for Aerospace Research, Canada; Srinivasan, Ramesh, Institute for Aerospace Research, Canada; System Identification for Integrated Aircraft Development and Flight Testing; March 1999, pp. 25-1 - 25-13; In English; See also 19990032449; Copyright Waived; Avail: CASI; A03, Hardcopy; A04, Microfiche

This paper describes the development of a higher-order, rotor dynamic mathematical model of a single-rotor helicopter from flight test data, and illustrates the improvements in model fidelity realized by the inclusion of higher-order terms in the model. This model development is based on flight data gathered from '3211' and 'frequency sweep' manoeuvres with the NRC Bell 412HP helicopter in hover. The data suite included the standard fuselage response parameters. This flight data was analysed using both the time domain (Maximum Likelihood Estimation or MLE) and frequency domain (CIFER) system identification techniques. The resulting models, from both the time and frequency domain techniques, with the various combinations of the higher-order rotor dynamic terms included, are compared to determine the improvements derived by each approach.
Author
Mathematical Models; Hovering; Helicopters; Dynamic Models; System Identification; Time Domain Analysis; Frequency Domain Analysis

19990032473 Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Inst. fuer Flugmechanik, Brunswick, Germany
DIRECT UPDATE OF A GLOBAL SIMULATION MODEL WITH INCREMENTS VIA SYSTEM IDENTIFICATION
Rohlf, D., Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; System Identification for Integrated Aircraft Development and Flight Testing; March 1999, pp. 28-1 - 28-11; In English; See also 19990032449; Copyright Waived; Avail: CASI; A03, Hardcopy; A04, Microfiche

This paper describes a method using system identification for a data base update where the aerodynamic coefficients derived from the original wind tunnel data base are supplemented by increments. The model update is performed applying a regression method to match the model calculated accelerations with the in-flight measured accelerations. The work is based on flight test data of the thrust-vectored research aircraft X-31A. Its simulation model is updated in the entire flight envelope using a representative selection from all flight maneuvers which became available in this project. More than 3000 seconds of flight test are evaluated in one identification run covering an angle of attach regime from about -5 deg up to 70 deg and Mach numbers from about 0.2 up to 1.25. A practice flight for the spectacular X-31A demonstration at the Paris Air Show '95 is used

for model verification. Thrust is calculated from flight measured power lever position using an existing static engine table model. A rate limited first order dynamic engine model with additional time lag to account for after-burner ignition is implemented. Thrust amount and thrust vector effectiveness are estimated separately for after-burner on and off. Actual c.g.-location, A/C weight and inertia are taken into account based on existing weight and balance data with measured fuel quantity as input. The latter is corrected for fuel slosh impact depending on tank filling ratio and translational A/C Accelerations.
Author
System Identification; Aerodynamic Coefficients; Flight Simulation; Mathematical Models; Data Processing; X-31 Aircraft

19990032474 Royal Military Coll. of Science, DAPS, Shrivenham, UK
ARMOR UAV IDENTIFICATION USING AN ADAPTIVE HYBRID GENETIC ALGORITHM
Bruce, Peter D., Royal Military Coll. of Science, UK; Kellett, Martin G., Royal Military Coll. of Science, UK; Azinheira, J. R., Instituto Superior Tecnico, Portugal; System Identification for Integrated Aircraft Development and Flight Testing; March 1999, pp. 29-1 - 29-7; In English; See also 19990032449; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

This paper presents the use of an Adaptive Hybrid Genetic Algorithm for the Maximum Likelihood identification of aircraft dynamics. The technique is compared to the conventional Modified Newton-Rhapson method and to the simplex method for the identification of a linear model of the dynamics of the ARMOR UAV. A simple example is used to illustrate the method's advantages when identifying nonlinear systems. The method has advantages over the Modified Newton-Rhapson method in that initial parameter estimates do not have to be stated, rather, a bound on the parameters is given. It also does not suffer from numerical problems sometimes evident with gradient-based optimisation techniques and it can locate the global minimum when a multi-modal cost function is present. It is also simple to incorporate initial parameter estimates if available.
Author
Genetic Algorithms; Maximum Likelihood Estimates; Aerodynamic Characteristics; Aircraft Stability; Aircraft Control; Parameter Identification; Aircraft Design

19990032477 Dassault Aviation, Direction Generale Technique, Saint-Cloud, France
ANALYSIS OF THE THEORETICAL MODELING OF THE COST OF ARMY AIRCRAFT BY FLIGHT VALIDATION *[SEPARATION DE CHARGE SOUS AVION D'ARMES DE LA MODELISATION THEROIQUE A LA VALIDATION EN VOL]*
Fleygnac, D., Dassault Aviation, France; Bariant, P., Dassault Aviation, France; Rapuc, M., Dassault Aviation, France; System Identification for Integrated Aircraft Development and Flight Testing; March 1999, pp. 32-1 - 32-12; In French; See also 19990032449; Copyright Waived; Avail: CASI; A03, Hardcopy; A04, Microfiche

The multiple aviation capability of former forces, especially the capacity to carry out multiple mission and various responsibilities assure their commitment to missions: bombing, guided missiles, and releasable ordnance. The cost of complying with this period of exigency permits only a new generation of aircraft such as RAFALE, which provide a capacity for greatly extended missions and developments concerning future armaments.
Transl. by CASI
Mathematical Models; Aerodynamic Characteristics; Aircraft Design; Flight Characteristics; Systems Engineering

19990040714 Research and Technology Organization, Systems Concepts and Integration Panel, Neuilly-sur-Seine, France
AIRCRAFT WEAPON SYSTEM COMPATIBILITY AND INTEGRATION *[COMPATIBILITE ET INTEGRATION DES SYSTEMES D'ARMES AEROPORTES]*
Aircraft Weapon System Compatibility and Integration; April 1999; 256p; In English; 3rd Symposium of the Systems Concepts and Integration Panel; 28-30 September 1998, Chester, UK; Sponsored by Research and Technology Organization, France; See also 19990040715 through 19990040736; Original contains color illustrations
Report No.(s): RTO-MP-16; AC/323(SCI)TP/8; ISBN 92-837-0007-4; Copyright Waived; Avail: CASI; A12, Hardcopy; A03, Microfiche

Economic constraints dictate that the lives of existing aircraft must be stretched, making the incorporation of new weapons and weapon systems into existing airframes necessary. These same constraints dictate that the corollary is also true, i.e. that new aircraft must cope with existing weapons as well as their new systems. Along these lines, the goal of this symposium was to critically review the overall state-of-the-art in aircraft weapon system compatibility and integration for the benefit of researchers, RDT&E managers, engineers, and operational staff employed by both contractor and supplier organisations within NATO. Illuminating possible paths for future development and providing beneficial ideas and experience was achieved as part of the overall objective of the symposium. Also, the symposium explored both fixed and rotary wing applications as they related to the above mentioned session areas. Overall, the attendees were quite pleased with the presentations along with a very informative roundtable discussion.
Author
Conferences; Weapon Systems; Weapon System Management; Systems Integration; Fighter Aircraft; Systems Compatibility; Trajectory Analysis; External Stores; External Store Separation

19990040717 Naval Air Systems Command, Advanced Aerodynamics Branch, Patuxent , MD USA
F/A-18C STORE CARRIAGE LOADS PREDICTION AND MUTUAL INTERFERENCE AERODYNAMICS
Kern, S. B., Naval Air Systems Command, USA; Findlay, D. B., Naval Air Systems Command, USA; Aircraft Weapon System Compatibility and Integration; April 1999, pp. 5-1 - 5-7; In English; See also 19990040714; Original contains color illustrations; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

A computational aerodynamics study of the integration of a variant of the Joint Direct Attack Munition (JDAM) store onto the F/A-18C aircraft was performed. Computational forces and moments, derived from hybrid Euler/Navier-Stokes solutions, correlated fairly well with available wind tunnel test data across a wide angle-of-attack range at both transonic and supersonic freestream flow conditions. The computational results were analyzed to explore the aerodynamic influence of the store on an adjacent fuel tank, and the aircraft wing and fuselage. The addition of the JDAM caused a 16% reduction in the outboard yawing moment of the 330 gallon tank. The presence of the store had nearly no effect on the forward 30% of wing; however, there were significant effects on both the upper and lower surfaces of the wing aft of mid-chord. The influence of the store was so pervasive that it was detectable as far forward as the canopy and as far aft as the empennage.
Author
F-18 Aircraft; Computational Fluid Dynamics; Aerodynamic Interference; External Store Separation; Wing-Fuselage Stores

19990040722 Naval Air Warfare Center, Aircraft Div., Patuxent River, MD USA
TESTING AND PROVING THE GBU-24 LASER-GUIDED BOMB FROM THE U.S NAVY'S F-14 AIRCRAFT
Cable, B., Naval Air Warfare Center, USA; Piranian, A., Naval Air Warfare Center, USA; Zaccardi, V., Naval Air Warfare Center, USA; Aircraft Weapon System Compatibility and Integration; April 1999, pp. 11-1 - 11-10; In English; See also 19990040714; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

When the U.S. Navy identified the requirement to carry and employ the Texas Instruments-Raytheon GBU-24 Laser Guided Bomb (LGB) hard target penetrator from the F-14 aircraft, its weapons compatibility/certification engineers had to modify the weapons flight test process which had been in use for determination of F-14 aircraft and Air-to-Ground (A/G) weapons compatibility. That process consisted of beginning tests at low Mach/airspeed in straight and level flight, and continuing tests, at incrementally greater speeds, through the highest Mach/airspeed and steepest flight path angles, with the acceptability of the weapon separation trajectory evaluated through film from aircraft-mounted cameras. The GBU-24, because of its large size and large deploying wing, had to be evaluated through an integrated test and evaluation process consisting of computational analyses, wind tunnel testing, ground testing, flight testing and photogrammetric analyses, used interdependently, to determine the extent of aircraft/weapon compatibility. The test process ultimately led to the authorization for all F-14 variants to carry and employ two GBU-24's on fuselage carriage stations. In

addition, the testing led to authorization for launching of an AIM-7 Air-to-Air missile from a fuselage carriage station which was behind the LGB A/G weapons.
Author
Flight Tests; Laser Guidance; External Store Separation; Systems Integration; Systems Compatibility; Ballistic Trajectories; Weapon Systems; Weapons Delivery; Computerized Simulation; Trajectory Analysis

19990040724 Naval Air Warfare Center, Aircraft Division, Patuxent River, MD USA
THE USA NAVY'S INTEGRATED APPROACH TO STORE SEPARATION ANALYSIS
Taverna, Frank, Naval Air Warfare Center, USA; Cenko, Alex, Naval Air Warfare Center, USA; Aircraft Weapon System Compatibility and Integration; April 1999, pp. 13-1 - 13-8; In English; See also 19990040714; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

The current USA Navy approach to store separation analysis employs a combination of wind tunnel testing, flight testing, and computational aerodynamic analysis. This Integrated Test and Evaluation approach ensures safe separation of stores in a timely and cost effective manner. This approach has evolved over the past decade and is unique because it is performed by an Integrated Product Team (IPT) which belongs to one, physically co-located organization. During the past several years this approach has been responsible for providing considerable time and cost savings to many programs, including the F-18C/JDAM, F-14/GBU-24, F-18C/JSOW, and DC-130/BQM-74 programs. This approach is presently being applied to the F/A-18E/F aircraft/store integration program to both reduce the program cost and ensure the success of the program.
Author
Aerodynamic Characteristics; External Store Separation; Design Analysis; Systems Integration; Systems Compatibility; Computerized Simulation; Flight Tests

19990040725 Naval Air Systems Command, Patuxent , MD USA
F/A-18E/F TRAJECTORY IMPROVEMENT STUDY
Chaddock, Dale R., Naval Air Systems Command, USA; Aircraft Weapon System Compatibility and Integration; April 1999, pp. 14-1 - 14-12; In English; See also 19990040714; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

The original F/A-18E/F configuration based on preliminary analysis predicted the existence of a major store separation problem due to a more adverse flowfield than the F/A-18C/D aircraft. Several reasons contribute to the problem which include a wider fuselage, larger wing area and thicker wing, new inlet design with more inlet spillage, and an additional pylon station on each wing. The wing pylon stations were left at there original locations relative to the aircraft centerline. After extensive weapons separation testing and trajectory analysis in the AEDC 16T transonic wind tunnel, it was projected that the current aircraft configuration had a major separation problem and would not meet the E/F release and jettison specification requirements. Therefore, a major trajectory improvement study was undertaken to improve the release and jettison operational envelopes.
Author
Aircraft Configurations; Trajectory Analysis; Ballistic Trajectories; Jettisoning; Wing-Fuselage Stores; External Store Separation; F-18 Aircraft; Flight Tests; Wind Tunnel Tests

19990040726 Royal Australian Air Force, Aircraft Research and Development Unit, Edinburgh, Australia
AIRCRAFT/STORES COMPATIBILITY: THE AUSTRALIAN PERSPECTIVE
Tutty, Malcolm G., Royal Australian Air Force, Australia; Aircraft Weapon System Compatibility and Integration; April 1999, pp. 15-1 - 15-12; In English; See also 19990040714; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

The Australian perspective of weapons/aircraft integration is presented in viewgraph form. The thrust of the presentation was to show the technical approach and organizational structure of how the Australians conduct the compatibility testing and clearance process. Their processes, their organizational structure, and philosophy is similar to that of the US. The Australians are now the only operators of the F-111 aircraft. They, like most other countries, have to work the integration issues of old and new aircraft and old and new weapons.
Derived from text
Military Aircraft; Weapons Delivery; Systems Integration; Weapon Systems; Systems Compatibility

19990040727 Naval Air Systems Command, Patuxent , MD USA
WEAPON SYSTEMS INTEGRATION IN EXISTING AIRCRAFT
Reiber, Carl, Naval Air Systems Command, USA; Aircraft Weapon System Compatibility and Integration; April 1999, pp. 16-1 - 16-6; In English; See also 19990040714; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

This paper addresses the primary factors that allow the acquisition process to purchase an effective retrofit kit that meets evolving U.S. Navy's P-3 Fleet requirements, using my personal experiences in the weapon systems integration and modifcation of existing P-3C aircraft. These factors are analogous to any aircraft modification encompassing weapons integration. Contributing factors include procurement policies, analog versus digital interfaces, man-machine interface, and testing. The pros and cons associated with the use of non-military standards, COTS, or NDI in a cost-effective way will also be exemplifed using the P-3C Update III Block Modification Upgrade Program (BMUP) that the U.S. Navy's Maritime Surveillance Aircraft Program Office is executing.
Author
P-3 Aircraft; Weapon Systems; Systems Integration; Systems Compatibility; Performance Tests; Systems Simulation; Mathematical Models

19990040728 Army Aviation and Missile Command, Aviation Research, Development, and Engineering Center, Redstone Arsenal, AL USA
ROTARY WING STORES INTEGRATION (RWSI) PROCESS
Obermark, J., Army Aviation and Missile Command, USA; Johnson, M., Army Aviation and Missile Command, USA; Aircraft Weapon System Compatibility and Integration; April 1999, pp. 18-1 - 18-6; In English; See also 19990040714; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

This paper gives an overview of the Rotary Wing Stores Integration (RWSI) process which has been developed to improve the current process of weapons integration with helicopters in the area of separation analysis. Several tools have been developed to implement this process. Their function and position within the process will be covered. Some background into the current process is provided. The current process is used to define the goals and requirements of the improved process. These requirements suggest the tools which are developed to implement the new process. The resultant tools are explained, along with their position and function within the new process. The verification and validation process of the tools is shown. The results and improvements which result from the new process are explained. Finally, the resultant process is analyzed to suggest improvements and tools for the future process.
Author
Rotary Wing Aircraft; External Store Separation; Weapon Systems; Systems Integration; Systems Compatibility; Computerized Simulation; Systems Engineering; Applications Programs (Computers); Mathematical Models

19990040729 Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Inst. fuer Flugmechanik, Brunswick, Germany
HELICOPTER/WEAPON SYSTEM INTEGRATION: AN OVERVIEW AND SYNOPSIS OF AGARD LS 209
Gmelin, Bernd L., Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; Aircraft Weapon System Compatibility and Integration; April 1999, pp. 19-1 - 19-10; In English; See also 19990040714; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

The helicopter is fast approaching a half century of service as a weapon system. From humble beginnings after World War II, largely in the roles of observation platforms and search and rescue vehicles, rotorcraft have evolved to a principal in the modern battle scenario. In the war at sea, the helicopter forms an integral part of a task force capable of launching devastating firepower at surface and subsurface targets. In the airland battle, technology has made the helicopter into a tank killer, troop transport and night observation platform. Finally, in the most unlikely arena, air-to-air combat, modern weap-

onry has shown the helicopter to be effective against even high performance tactical aircraft. Under ideal circumstances a new helicopter design is being directed towards certain weapon capabilities, making the weapon integration discipline a mature part of the design process. However, the rapid pace of weapons development often leads to airframe modification programs and weapons kits make high-technology weapons subsystems a part of older aircraft. In such cases, the system integration efforts is sometimes reduced to 'cut-and-try'. At best, such an approach may be inefficient at worst it may be unsafe. The AGARD Flight Vehicle integration Panel and the Consultant and Exchange Programme decided to set up in 1997 the Lecture Series 209 on Helicopter/Weapon System Integration. The Lecture Series considered the problems of integrating externally mounted weapons on helicopters with the focus on aeromechanical, structural and operational issues. New aspects in the field of helicopter/weapon system integration were addressed and strong emphasis was placed on the lessons learned from recent experiences in actual development programs. Case histories of weapons integration on the AH-64 Apache, the RAM-66 Comanche, the EH-101, and the Tiger were presented and discussed. This paper is intended to give an overview of the material provided in the lectures and to draw some essential conclusions from the discussions.
Author
Military Helicopters; Weapon Systems; Weapons Development; Systems Integration; Systems Compatibility; Aircraft Configurations

19990040730 Naval Air Warfare Center, Airframe, Ordnance, and Propulsion Div., China Lake, CA USA
APPLICATIONS OF MODERN MULTIDISCIPLINARY APPROACHES TO THE INTEGRATION OF WEAPONS ON AIRCRAFT
Jeter, Edward L., Naval Air Warfare Center, USA; Aircraft Weapon System Compatibility and Integration; April 1999, pp. 20-1 - 20-14; In English; See also 19990040714; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

Modern computational methods are used extensively in the weapon integration process. These methods include, but are not limited to, computational fluid dynamics (CFD), three-dimensional solids modeling, finite element methods, linear and nonlinear structural mechanics, and multi-body dynamic systems analysis. While CFD methods are commonly used for aerodynamic predictions, the magnitude of numerical calculations associated with them often precludes their integration into multidisciplinary design environments. On the other hand, modern aerodynamic analysis procedures based on subsonic and supersonic panel methods are appropriate and have been incorporated into these environments. These procedures are called 'engineering methods,' and they have been combined with structural analyses, design, flight tests, and dynamic simulation to evaluate weapon/aircraft integration issues. An overview of this process is described and examples from actual weapons integration efforts are discussed. It is shown that these modern engineering methods are accurate and efficient, and can be utilized to complement procedures employed for weapons integration. Conclusions, lessons learned, and recommendations for future efforts are emphasized.
Author
Aircraft Configurations; Weapon Systems; Systems Integration; Systems Compatibility; Design Analysis; Multidisciplinary Design Optimization; Applications Programs (Computers)

19990040731 Dassault Aviation, Direction Generale Technique/Direction Technique Systeme, Saint-Cloud, France
HOW TO CONTROL THE CROSS COMPLEXITY OF THE INTEGRATION OF ARMAMENT IN A COMBAT AIRCRAFT? *[COMMENT MAITRISER LA COMPLEXITIE CROISSANTE DE L'INTEGRATION DES ARMEMENTS A UN AVION DE COMBAT?]*
Chivot, Francois, Dassault Aviation, France; Aircraft Weapon System Compatibility and Integration; April 1999, pp. 21-1 - 21-10; In French; See also 19990040714; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

Since the middle of the 80's, the integration of armaments to a carrier has become more and more complex, requiring an augmentation of cycles and costs supported finally by usage. This phenomenon has been particularly stressed in later years. The result of the integration of the number and nature of these interactions is due in part to the budgetary constraints of the other. In this context it is therefore necessary to perform evaluations for the actual process definition and development of the combination of 'aircraft plus armament'. Through the example of Air to Surface weapons, this paper proposes to present the evolution of the processes recommended by Dassault Aviation in view of controlling these cross complexities.
Transl. by CASI
Weapon Systems; Systems Integration; Systems Compatibility; Fighter Aircraft; Systems Management

19990040733 Daimler-Benz Aerospace A.G., Military Aircraft Div., Munich, Germany
STRUCTURAL DEFORMATION: A NEW CHALLENGE TO THE ACCURACY OF SEPARATION CODES
Deslandes, R., Daimler-Benz Aerospace A.G., Germany; Aircraft Weapon System Compatibility and Integration; April 1999, pp. 23-1 - 23-10; In English; See also 19990040714; Original contains color illustrations; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

In general, the state of the art analysis of the separation behaviour of an external store doesn't consider the effects of local structural deformations of the carriage devices and launch equipment. Such deformations may be caused by steady/unsteady inertia and aerodynamic loads. The order of magnitude of such deformations ranges between tenths of degrees up to values of several units. If neglected within the prediction of separation behaviour, a consecutive flight test result normally comes up with a bad evidence. The intention of this paper is to demonstrate such adverse effects which are typical for fighter aircraft carrying external stores. A way ahead will indicate how to overcome these problems by implementing more accurately measured initial conditions into the postflight separation analysis. Thereby store trajectories computed with conventionally gathered initial conditions will be shown in comparison with conditions derived from inflight deformation measurements in order to underline the relevance of such corrections with respect to separation autopilot design and with respect to the clearance work.
Author
External Stores; External Store Separation; Fighter Aircraft; Elastic Deformation; Structural Analysis; Trajectory Analysis; Computerized Simulation; Applications Programs (Computers)

19990040734 Air Force Research Lab., Wright-Patterson AFB, OH USA
A COOPERATIVE RESPONSE TO FUTURE WEAPONS INTEGRATION NEEDS
Grove, James E., Air Force Research Lab., USA; Pinney, Mark A., Air Force Research Lab., USA; Stanek, Michael J., Air Force Research Lab., USA; Aircraft Weapon System Compatibility and Integration; April 1999, pp. 24-1 - 24-12; In English; See also 19990040714; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

As military aircraft are designed for more complex and demanding missions, integrating weapons becomes an increasingly difficult task. To address the needs of the weapons integration community, in the face of shrinking defense budgets, Air Force Research Laboratory (AFRL) has initiated national/international cooperative efforts designed to address key integration issues. The efforts are focused in three areas; integrated design/analysis software and data management, active control of weapons bay environments, and low drag, survivable external carriage options.
Author
Systems Integration; Design Analysis; External Stores; External Store Separation; Computerized Simulation; Weapon Systems; Weapon System Management

19990040735 Matra BAe Dynamics, Velizy-Villacoublay, France
THE ROLE OF THE MISSILEER IN THE INTEGRATION OF A TACTICAL MISSILE TO AN AIRCRAFT: THE EXAMPLE OF PROGRAM 2000-5 *[LE ROLE DU MISSILIER DANS UNE INTEGRATION D'UN MISSILE TACTIQUE A UN AERONEF: EXEMPLE DU PROGRAMME 2000-5]*
Boischot, M., Matra BAe Dynamics, France; Aircraft Weapon System Compatibility and Integration; April 1999, pp. 25-1 - 25-6; In French; See also 19990040714; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

The complexity of modern armament systems, from the point of view of missiles requires an entire program for the adaptation of a

missile to an aircraft, the increasing costs, and the so called separation of missile development. The Matra BAe Dynamics organization has generated a program of integration with a distinct team which is occupied with the development of missiles. We will see that to properly conduct such a program, the early participation of the missileer is necessary in the studies of the employment concept because he provides his knowledge of the missile and his experience with previous adaptations.
Transl. by CASI
Fighter Aircraft; Missile Systems; Systems Integration

19990053144 Pennsylvania State Univ., Dept. of Aerospace Engineering, University Park, PA USA
RECENT DEVELOPMENT IN THE ANALYTICAL INVESTIGATION OF SHIPBOARD ROTORCRAFT ENGAGE AND DISENGAGE OPERATIONS
Smith, Edward C., Pennsylvania State Univ., USA; Keller, Jonathan A., Pennsylvania State Univ., USA; Kang, Hao, Pennsylvania State Univ., USA; Fluid Dynamics Problems of Vehicles Operating Near or in the Air-Sea Interface; February 1999, pp. 1-1 - 1-18; In English; See also 19990053143; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

This paper presents an overview of recent developments in an effort to predict transient aeroelastic rotor response during shipboard engage and disengage sequences. The blade is modeled as an elastic beam undergoing in flap, lag, extension and torsion. The blade equations of motion are formulated using Hamilton's principle and they are spatially discretized using the finite element method. The discretized blade equations of motion are integrated for a specified rotor speed run-up or run-down profile. Blade element theory is used to calculate quasi-steady or unsteady aerodynamic loads in linear and nonlinear regimes. The analysis is capable of simulating both articulated, hingeless, and gimballed rotor systems. Validation of the rotor code is discussed, including correlation with droop stop impact tests and wind tunnel experiments. Predictions of safe engagement and disengagement envelopes, limited by excessive blade tip deflections or hub moments, are presented. Future directions of study are also discussed.
Author
Aeroelasticity; Finite Element Method; Equations Of Motion; Unsteady Aerodynamics; Transient Response; Rotors

19990053165 Krylov Shipbuilding Research Inst., Saint Petersburg, Russia
CONCEPTUAL BASES OF WIG CRAFT BUILDING: IDEAS, REALITY AND OUTLOOKS
Aframeev, E. A., Krylov Shipbuilding Research Inst., Russia; Fluid Dynamics Problems of Vehicles Operating Near or in the Air-Sea Interface; February 1999, pp. 22-1 - 22-18; In English; See also 19990053143; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

Wing-in-Ground (WIG) craft (ekranoplans) building has sufficiently long history but till now there is not any established view on their technical appearance and place in the system of transport means. It was assumed that technical and economical characteristics of WIG craft wittingly exceeded those of competitive transport means: aircraft (and hydroaeroplanes) because of the high lift-to-drag ratio value (aerodynamic efficiency). However in reality they don't a priori provide the superiority over the aircraft (hydroaeroplanes). Now it is necessary to revise the conceptual base of WIG craft building. The idea of creation of second generation ekranoplans on the base of a the A-conception, suggested by the author in 1977, assumes that they are created as marine transport means with high ship features when sailing (air transport means, including hydroaeroplanes, doesn't possess such features), i.e. as two-mode vehicles. Realization of this conception puts the ekranoplans out of competition as compare with other classes of engineering in the cases when it is necessary to stay at sea for a long time. At the same time such ekranoplans have the incomparably high level of safety when using for the transportation of passengers and cargo. In the near-term future the sphere of WIG craft application can be significantly expanded and include not only the transportation but such important missions as the creation of global sea rescue system or sea launch of space vehicles. In the more remote future it may be possible to realize the trans-ocean transportation, however this mission requires the creation of superheavy ekranoplans what in turn requires the solution of some complicated technical problems.
Author
Air Transportation; Transport Aircraft; Aerospace Planes; Aerospace Engineering; Aircraft Design; Design Analysis; Ground Effect (Aerodynamics); Ground Effect Machines

19990053167 Joint Stock Co. Agency for Technologies and Transport, Nizhny Novgorod, Russia
THE FIRST COMMERCIAL EKRANOPLAN 'AMPHISTAR' AND PROSPECTS FOR THE DEVELOPMENT OF PASSENGER EKRANOPLANS
Sinitsyn, D. N., Joint Stock Co. Agency for Technologies and Transport, Russia; Maskalik, A. I., Joint Stock Co. Agency for Technologies and Transport, Russia; Fluid Dynamics Problems of Vehicles Operating Near or in the Air-Sea Interface; February 1999, pp. 24-1 - 24-18; In English; See also 19990053143; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

The background and evolution of ekranoplan development in Russia is described in the paper. The data are given on the developed ekranoplans including the first civilian ekranoplans 'Amphistar'. The whole range of marine passenger ekranoplans (MPE) developed by the Russian 'Technologies and Transport' JSC is shown. The description of the Marine Passenger Ekranoplan MPE-200 is presented together with conclusions concerning prospects for the development of passenger ekranoplans.
Author
Commercial Aircraft; Air Transportation; Aircraft Design; Ground Effect Machines

20000011749 NASA Johnson Space Center, Houston, TX USA
THE TACTILE SITUATION AWARENESS SYSTEM IN ROTARY WING AIRCRAFT: FLIGHT TEST RESULTS
Raj, Anil K., University of West Florida, USA; Suri, Niranjan, University of West Florida, USA; Braithwaite, Malcolm G., Army Air Corps, UK; Rupert, Angus, NASA Johnson Space Center, USA; Current Aeromedical Issues in Rotary Wing Operations; August 1999, pp. 16-1 - 16-7; In English; See also 20000011735; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

Loss of Situation Awareness (SA) and Spatial Disorientation (SD) contribute significantly to aviation mishaps involving rotary wing aircraft. The Tactile Situation Awareness System (TSAS) was developed to improve SA by presenting three dimensional orientation information to pilots and aircrew intuitively via somatic tactile sensory receptors. Results from simulator and flight tests have demonstrated improved SA when using TSAS and a decreased perceived workload. Seven research pilots from the U.S. Army Aeromedical Research Laboratory and the U.S. Naval Aerospace Medical Research Laboratory performed flight tests in an U.S. Army, UH-60 helicopter. The first series dealt with forward flight maneuvers including straight and level flight, standard rate turns, unusual attitude recoveries and ground controlled approaches (to minimum altittide). In this series the subject pilots wore a blackout visor to exclude any visual cues. TSAS provided aircraft pitch, roll, airspeed and heading, acquired from flight instruments via tactile transducers (tactors) applied to the body of the pilot. The second series dealt with hover maintenance (in and out of ground effect) and transitions to and from forward flight and lateral translations. Pilots in this series wore semi-fogged spectacles to exclude external visual cues while maintaining clear of instrument displays; TSAS provided translational velocity data. In both test series pilots reported increased SA and decreased workload when using TSAS. TSAS improved accuracy in hovering maneuvers and forward flight. Pilots felt oriented with TSAS regardless of vestibular illusions generated during flight. Pilots reported adequate spatial orientation despite attempts to disorient them. Pilots hovering out of ground effect held position more accurately confidently performed simulated shipboard take-off and landings without external visual cues. TSAS can provide significant SA improvement in rotary wing aircraft while reducing pilot workload. Further development toward a deployable system is warranted.
Author
Aerospace Medicine; Flight Tests; Disorientation; Workloads (Psychophysiology); Visual Stimuli; Flight Simulators; Uh-60a Helicopter; Test Pilots

20000032684 Asian Office of Aerospace Research and Development, Tokyo, Japan
OPERATIONAL NEED
Lyons, T. J., Asian Office of Aerospace Research and Development, Japan; Human Consequences of Agile Aircraft; March 2000, pp. 1 - 1 - 1 - 4; In English; See also 20000032683; Copyright Waived; Avail: CASI; A01, Hardcopy

Between April 1997 and October 1998, Working Group #27 conducted discussions with experienced military fighter pilots and test pilots concerning the human factor implications of agile aircraft flight. Aircrews interviewed included 23 U.S.pilots (consisting of 5 NASA Test Pilots, 13 USAF Air Warfare Center Pilots, and 5 USAF Pilot-Physicians), 11 Swedish Air Force operational pilots, 3 German Air Force test pilots, and 2 French pilots. After the discussions, the aircrews were asked to complete an anonymous questionnaire. (Note, the French pilots were interviewed before the questionnaire was completed and so their views are represented in the pilot comments, but not in the actual questionnaire results.) In addition to the questionnaire results, one-on-one interviews were conducted with many of the pilots. A world wide representation of most agile aircraft was achieved by surveying pilots experienced with the X-31, F-18 HARV, F-15 Active, MATV, Harrier, F-22, F-18, MIG-29, Rafale, Gripen, and Eurofighter. As a part of the questionnaire, the aircrew members were asked background questions concerning their flying experience. The remainder of the questionnaire involved rating the utility of various aircraft capabilities (e.g., high AOA/post-stall maneuvering, negative G maneuvering, high (+12) Gz maneuvering) with regard to their contribution to air-to-air combat performance. A seven point scale was used to rate the perceived contributions to air combat effectiveness. Specifically, ratings ranged from I for 'Not at all useful', 3 for 'Slightly useful', 5 for 'Moderately useful', to 7 for 'Very useful.' The aircrews were, on the average, very experienced with an average flying time of 2,589 hours (range 900-9,000). Note that some pilots did not have experience with helmet mounted sights or advanced anti-G suits. Hence, they did not rate these systems. Combat Edge (the USAF positive pressure breathing system for G protection) and the Advanced Technology Anti-G suit were included as known benchmarks against which to judge the pilot responses. Pilots rated helmet-mounted sights, high AOA maneuvering, and high G capability all highly. Ratings of negative Gs varied widely among the responders. Some interesting differences were noted in the responses of the Swedish pilots compared with the U.S. and German pilots. On the average, Swedish pilots valued airframe agility (capability to pull +12 Gz and -Gz) less. This could be due to several factors including: (1) lower average flying experience (flying hours) in the Swedish pilots interviewed; (2) the Swedish pilots included mainly operational pilots rather than test pilots; or (3) national differences. In summary, the pilots surveyed viewed the capabilities afforded by agile aircraft as useful for combat. The following sections provide additional detail from the questionnaire data and debriefing comments that specifically pertains to human factors issues, including physiologic problems, the pilot-vehicle interface, selection, and training. The final section reexamines the pilots' view of agile flight.
Author
Aircraft Pilots; Human Factors Engineering; Surveys; Aircraft Equipment; Flight Instruments; Physiological Factors; Pilot Performance

20000032860 NASA Langley Research Center, Hampton, VA USA
THE SIGNIFICANCE OF SMALL CRACKS IN FATIGUE DESIGN CONCEPTS AS RELATED TO ROTORCRAFT METALLIC DYNAMIC COMPONENTS
Everett, R. A., Jr., NASA Langley Research Center, USA; Elber, W., NASA Langley Research Center, USA; Application of Damage Tolerance Principles for Improved Airworthiness of Rotorcraft; February 2000, pp. 1 - 1 - 1 - 14; In English; See also 20000032859; Copyright Waived; Avail: CASI; A03, Hardcopy

In this paper the significance of the 'small' crack effect as defined in fracture mechanics will be discussed as it relates to life managing rotorcraft dynamic components using the conventional safe-life, the flaw tolerant safe-life, and the damage tolerance design philosophies. These topics will be introduced starting with an explanation of the small-crack theory, then showing how small-crack theory has been used to predict the total fatigue life of fatigue laboratory test coupons with and without flaws, and concluding with how small cracks can affect the crack-growth damage tolerance design philosophy. As stated in this paper the 'small' crack effect is defined in fracture mechanics where it has been observed that cracks on the order of 300 microns or less in length will propagate at higher growth rates than long cracks and also will grow at AK values below the long crack AK threshold. The small-crack effect is illustrated herein as resulting from a lack of crack closure and is explained based on continuum mechanics principles using crack-closure concepts in fracture mechanics.
Author
Crack Propagation; Cracks; Damage; Fatigue Life; Fatigue Tests; Fracture Mechanics; Rotary Wing Aircraft; Tolerances (Mechanics); Aircraft Reliability

20000032869 Naval Air Warfare Center, Aircraft Div., Patuxent River, MD USA
THE US NAVY'S HELICOPTER INTEGRATED DIAGNOSTICS SYSTEM (HIDS) PROGRAM: POWER DRIVE TRAIN CRACK DETECTION DIAGNOSTICS AND PROGNOSTICS, LIFE USAGE MONITORING, AND DAMAGE TOLERANCE; TECHNIQUES, METHODOLOGIES, AND EXPERIENCES
Hess, Andrew, Naval Air Warfare Center, USA; Hardman, William, Naval Air Warfare Center, USA; Chin, Harrison, Goodrich (B. F.) Aerospace, USA; Gill, John, Goodrich (B. F.) Aerospace, USA; Application of Damage Tolerance Principles for Improved Airworthiness of Rotorcraft; February 2000, pp. 13 - 1 - 13 - 22; In English; See also 20000032859; Copyright Waived; Avail: CASI; A03, Hardcopy

The evolution of automated diagnostic systems for helicopter mechanical systems has been greatly advanced by the Navy, in a program of systematic testing of drive train components having known anomalies (seeded faults) while simultaneously executing a suite of diagnostic techniques to identify and classify the mechanical anomalies. This program, called the Helicopter Integrated Diagnostic System (HIDS) was carried out using both an iron bird test stand and SH-6OB/F flight vehicles. The SH-60 HIDS program has been the Navy's cornerstone effort to develop, demonstrate, and justify integrated mechanical diagnostic system capabilities for its various helicopter fleets. The objectives of the original program were to: (1) Acquire raw data for multiple cases of 'good' and seeded fault mechanical components on a fully instrumented drive train to support the evaluation of diagnostic algorithms and fault isolation matrices. Data is being acquired from 32 vibration channels simultaneously at 100 kHz per channel while a continuous usage monitoring system records parametric steady state data from the power plant and air&ante. (2) Analyze vibration and other diagnostic indicators to evaluate sensitivity and performance of all available diagnostic methods when analyzing well-documented parts and their associated failure modes. Evaluate relative effectiveness of these various diagnostic methods, indicators, and their associated algorithms to identify and optimize sensor location combinations. (3) Demonstrate the ability to integrate and automate the data acquisition, diagnostic, fault evaluation and communication processes in a flight worthy system. (4) Integrate and evaluate comprehensive engine monitoring, gearbox and drive train vibration diagnostics, advanced oil debris monitoring, in-flight rotor track and balance, parts life usage tracking, automated flight regime recognition, power assurance checks and trending, and automated maintenance forecasting in a well-coordinated on-board and ground-based system. (5) Provide an extensive library of high quality vibration data on baseline and seeded fault components. This data can be made available to anyone wanting to prove their diagnostic techniques or develop new capability. (6) Provide a 'showcase', state-of-the-art, fully functional Integrated Mechanical Diagnostic system to act as a catalyst demonstration which might lead to interest in a fleet wide production application. This paper will describe the HIDS program background, development, system capabilities, and accomplishments; but will also focus on the most recent demonstrated drive train crack detection diagnostic techniques; aircraft component life usage monitoring philosophies and capabilities; and damage tolerance methodologies. Data and results from both the seeded fault 'iron bird' test cell rig and flight test aircraft will be presented. Experience, results, and lessons learned will be emphasized. HIDS initiated functions and capabilities being applied to the commercial off-the-shelf (COTS) SH-60 Integrated Mechanical Diagnostics System (IMDS) production program will be described. Conclusions and lessons learned that can be applied to future Helicopter Usage Monitoring

Systems (HUMS) and/or Integrated Mechanical Diagnostic (IMD) systems will also be discussed.
Author
Systems Health Monitoring; Helicopters; Tolerances (Mechanics); Rotor Aerodynamics; Failure Modes; Flight Tests; Aircraft Reliability

20000032872 Federal Aviation Administration, Los Angeles Aircraft Certificaion Office, Lakewood, CA USA
STRATEGIES FOR ENSURING ROTORCRAFT STRUCTURAL INTEGRITY
Eastin, Robert G., Federal Aviation Administration, USA; Application of Damage Tolerance Principles for Improved Airworthiness of Rotorcraft; February 2000, pp. 17 - 1 - 17 - 6; In English; See also 20000032859; Copyright Waived; Avail: CASI; A02, Hardcopy

Part 29.571 contains several strategies that, with certain qualification, applicants are allowed to adopt to ensure adequate structural integrity throughout the operational life of a rotorcraft. There has been a continuing debate concerning the merits of the various strategies. Much of the discussion has centered on the damage tolerance versus the flaw tolerance philosophies and the pros and cons of each. Additionally, the appropriate role of the traditional safe-life philosophy has been debated at length. This paper begins by considering what the objective of Part 29.571 is and then examines each of the strategies and their strengths and weaknesses. Following this a recommended strategy is proposed which is believed to offer the most rational path at the present time to achieving the stated objective.
Derived from text
Damage; Rotary Wing Aircraft; Structural Failure; Tolerances (Mechanics); Structural Reliability; Aircraft Structures; Systems Health Monitoring; Cracks

20000032874 Westland Helicopters Ltd., Yeovil, UK
APPLICATION OF DAMAGE TOLERANCE TO THE EH101 AIRFRAME
Matthew, David, Westland Helicopters Ltd., UK; Application of Damage Tolerance Principles for Improved Airworthiness of Rotorcraft; February 2000, pp. 9 - 1 - 9 - 8; In English; See also 20000032859; Copyright Waived; Avail: CASI; A02, Hardcopy

This paper presents the work carried out by GKN Westland Helicopters in the damage tolerance evaluation of the EH101 airframe. A comprehensive programme of crack growth testing and analysis was undertaken and is described in this paper. A simplified analysis method was developed and used to predict flaw growth in the Main Load Path structure of the EH101. The analysis showed that high frequency vibratory loads exceed the crack growth threshold at relatively short crack lengths. This has been confirmed by a full-scale airframe crack growth test in which a 4mm crack was propagated under representative loading. These results have led to the adoption of the 'Flaw Tolerant (Enhanced) Safe Life' approach for fatigue critical components on the EH101 airframe.
Author
Damage; Tolerances (Mechanics); Cracks; Crack Propagation; Eh-101 Helicopter; Fracturing

20000037805 Textron Bell Helicopter, H-1 Upgrade Program, Fort Worth, TX USA
THE H-1 UPGRADE PROGRAM: AFFORDABLE WAR FIGHTING CAPABILITY FOR THE US MARINES
Myers, Alan W., Textron Bell Helicopter, USA; Advances in Vehicle Systems Concepts and Integration; April 2000, pp. A2-1 - A2-18; In English; See also 20000037804; Copyright Waived; Avail: CASI; A03, Hardcopy

In late 1996, Bell Helicopter Textron Inc. was awarded a contract from the USA Marine Corps for the H-1 Upgrade Program. The program award was preceded by studies of all aircraft and approaches available to provide helicopter war fighting capability for the Marine Air Ground Task Force through the first quarter of the 21st century and beyond. Upgrades were defined for both the UH-1N utility helicopter and the AH-1W attack helicopter to integrate the following enhancements: Improved mission capability; Increased performance and maneuverability; Additional survivability features; Reduced pilot workload; Potential for growth; These enhancements give the Marine Corps the equivalent of new, state-of-the-art, zero-time aircraft, with 10,000-hour service lives. Total ownership cost affordability was, of course, a major requirement. Commonality, improvements in reliability and maintainability, the use of COTS/NDI equipment, and the reuse of existing equipment were encouraged to enhance squadron operability and supportability and help reduce recurring and O&S costs. Cost As An Independent Variable (CAIV) studies were also required to continuously evaluate potential cost reduction elements in trade against program and technical requirements. Bell and NAVAIR formed Integrated Product Teams (IPT) with representatives from all functional disciplines, to improve communication and to ensure the configuration designs were not only adequate technically but were also cost-effective to manufacture and to operate and support in the fleet. This IPT process has been instrumental in improving the contractor/customer approval process during design reviews. This paper summarizes the H-1 Upgrade Program. The Marine Corps modernization plan is described and the role of the H-1 is defined. The resulting configurations are described, as is the process of optimizing configuration details within program constraints.
Author
Upgrading; Maneuverability; Warfare; Aircraft Survivability

20000037806 British Aerospace Public Ltd. Co., Military Aircraft and Aerostructures, Preston, UK
THE TORNADO GR4 PROGRAMME: A NEW APPROACH
Watkins, T., British Aerospace Public Ltd. Co., UK; Advances in Vehicle Systems Concepts and Integration; April 2000, pp. A4-1 - A4-9; In English; See also 20000037804; Copyright Waived; Avail: CASI; A02, Hardcopy

The growing costs of new weapon systems will encourage potential customers to consider upgrading their existing fleets. Today's aircraft will therefore be expected to remain longer in service and counter the threats of the future. Industry will need to adapt from developing and manufacturing new weapon systems to finding ways to improve the capability of an existing asset to maintain a deterrent in a higher technological environment. According to the 1997 British Aerospace Military Aircraft Value Plan 'The upgrade and re-life of existing aircraft is a valuable market opportunity - over the past five years the upgrade of existing assets has accounted for 16 per cent of the total value of combat orders world-wide'. The RAF's IDS (Interdictor Strike) Tornado aircraft are expected to have a service life-span of up to 40 years and to ensure their combat effectiveness are currently undergoing a Mid Life Update (MLU) - the largest of its kind in Europe. The Mid Life Update programme returns 142 IDS Tornado aircraft to industry and upgrades them to a new variant, designated Tornado GR4/4A, which will become the new common standard for the RAF IDS aircraft. This paper will provide an introductory overview of the programme looking at the historical backcloth, the three contract elements, and how we are tackling the future requirements of our customer. Finally the paper considers why an update for the Tornado was the right approach for the RAF in its quest to maintain an effective capability to match the defence needs of the UK in the early 21st century.
Author
Weapon Systems; Manufacturing; Upgrading; Mrca Aircraft

20000037807 Dassault Aviation, Direction Technique Systemes, Saint-Cloud, France
MIRAGE 2000 COMBAT AIRCRAFT UPGRADE IN DASSAULT AVIATION: SOLUTION FOR NWDS SYSTEM OPEN AND AFFORDABLE
Picard, Alain, Dassault Aviation, France; Madon, Laurent, Dassault Aviation, France; Advances in Vehicle Systems Concepts and Integration; April 2000, pp. A5-1 - A5-4; In English; See also 20000037804; Copyright Waived; Avail: CASI; A01, Hardcopy

MIRAGE 2000 are in operational service within several Air Forces since 1983. The outstanding structural sturdiness of the Mirage allowing them to fly over 2015-2020, allow Dassault Aviation to consider mid-life update. MIRAGE 2000 mid-life update shall comply with the following criteria : Multirole aircraft, able to carry a wide variety of Air to Air and Air to Surface missions, Affordable costs, Replacement of current sensors (for example : RDM radar) by state of the art modern sensors with up to date operational performances (for example : multi shoot fire control), Replacement of the current WNDS core system by an open system based on modular avionics architecture allowing, in particular, to separate application software and hardware, Replacement of the current cockpit lay out by a modern glass cockpit taking benefit of the numerous advantages of the Man - Machine - Interface fitted on the MIRAGE 2000-5,

Implementation of new functions, by the customer's national industry, thanks to a modem software workshop installed at the customer's facilities. The target of this mid-life update is to obtain a new version of MIRAGE 2000 with a fly away price for new aircraft of 80% of the one of MIRAGE 2000-5 but with attractive operational characteristics.
Author
Software Engineering; Upgrading; Mirage Aircraft

20000037808 National Defence Headquarters, Ottawa, Ontario Canada
AIRCRAFT LIFE EXTENSION: CC130 HERCULES AVIONICS UPDATE
Daley, C. P., National Defence Headquarters, Canada; Advances in Vehicle Systems Concepts and Integration; April 2000, pp. A10-1 - A10-11; In English; See also 20000037804; Copyright Waived; Avail: CASI; A03, Hardcopy

The Canadian Department of National Defence (DND), having taken measures to ensure the structural integrity of the CC130 Hercules to beyond 2010, studied a number of technical and economic options with respect to extending the life of its ageing CC130 Hercules avionics suite. The Department selected the option of a consolidated and comprehensive avionics update as the preferred option to ensure the aircraft can perform its missions with peak efficiency and that the avionics would meet or outlast the estimated life expectancy for the aircraft.
Author
Structural Failure; Upgrading; Life (Durability); C-130 Aircraft

20000037809 Alenia Aeronautica, Turin, Italy
ENHANCING TACTICAL TRANSPORT CAPABILITIES: COCKPIT EVOLUTION FROM G222 TO C-27J
Evangelisti, Gianluca, Alenia Aeronautica, Italy; Spinoni, Maurizio, Alenia Aeronautica, Italy; Jones, Patrick F., Lockheed Martin Aeronautical Systems, USA; Advances in Vehicle Systems Concepts and Integration; April 2000, pp. A11-1 - A11-9; In English; See also 20000037804; Copyright Waived; Avail: CASI; A02, Hardcopy

The C-27J is the latest derivative of the service-proven G222 tactical transport. With over 20 years of production and more than 100 aircraft delivered, the G222 has served the military transport needs of Air Forces around the world including the Italian Air Force (AMI) and USAF. In 1996, Alenia Aerospazio and Lockheed Martin Aeronautical Systems (LMAS) decided to jointly develop the C-27J Spartan tactical transport aircraft. Based on the rugged G222 / C-27A design, the C-27J maintains the existing well-proven military airframe while updating those systems that could best take advantage of state-of-the-art technologies. The avionics, propulsion, and general aircraft systems were selected for upgrades, including the incorporation of avionics and cockpit upgrades developed for and certified on the LMAS C-130J aircraft. After a brief historic overview of the G222 family, from its early VTOL roots through intermediate experiences such as the USAF C-27A and Italian Air Force G222 3A avionics modernization program, this paper illustrates the process followed for the development of the C-27J cockpit. The process used to select a cockpit configuration that allows optimized operational capabilities while reducing overall development costs is presented, together with a description of main cockpit features.
Author
Cockpits; Upgrading; Structural Design

20000037812 Defence Evaluation Research Agency, Farnborough, UK
INTEGRATION OF DEFENSIVE AIDS
Zanker, Philip M., Defence Evaluation Research Agency, UK; Advances in Vehicle Systems Concepts and Integration; April 2000, pp. A14-1 - A14-10; In English; See also 20000037804; Copyright Waived; Avail: CASI; A02, Hardcopy

This paper, arising from project and research work at DERA UK, considers the application of, and options and possibilities for, the integration of electronic combat (EC) equipments, specifically defensive aids systems (DAS) into air vehicles, focusing upon the problems and issues of retrofit and upgrade programmes. The paper describes the threat to air platforms, citing both intense conflict and peace - keeping scenarios, and introduces the potential advantages of fully integrated defensive aids in terms of aircraft survivability, and in contributing towards overall situational awareness. The retrofit and integration of defensive aids into an in-service aircraft present some challenging problems. The level of integration is a determinant of the cost and complexity of the programme. The choices range from the basic mechanical integration of separate subsystems; through the integration of a defensive aids system within itself; the integration of the system into existing cockpit displays and controls and into other avionic systems; to the ultimate level of integration in which the defensive aids become an intimate part of the flight avionics suite. The style of avionics and cockpit controls present in the target aircraft is another key factor in the cost and complexity of the upgrade task. Retrofit into well integrated avionics, and multifunction displays, implies that software modification, and hence re-certification, will represent a major part of the integration task. The paper describes the features of integration which may be achieved at the different integration levels. A high level of integration is needed to facilitate data fusion, an important contributor to situational awareness. The paper discusses the structure of data fusion implementations, and the accompanying problems. Modifications and additions to ground support elements are identified as essential to the success of the retrofit or upgrade programme as a whole. The desired level of EC integration will be driven by the customer's specification, which in turn is scoped by his understanding of the detailed issues in integration: the features and facilities which are both feasible and operationally useful. The risk exists that integration features may be sacrificed to contain costs, resulting in fits of expensive and capable items of kit which cannot be used operationally to their full potential.
Author
Upgrading; Avionics; Defense Program; Systems Engineering; Systems Integration

20000037817 Flight Test Squadron (0416th), Edwards AFB, CA USA
LESSONS FROM THE FRONT LINE: THE ROLE OF FLIGHT TEST IN AIRCRAFT UPDATE PROGRAMS
Hoey, David J., Flight Test Squadron (0416th), USA; Skeen, Matt E., Flight Test Squadron (0416th), USA; Thomas, Evan C., Flight Test Squadron (0416th), USA; Advances in Vehicle Systems Concepts and Integration; April 2000, pp. A21-1 - A21-6; In English; See also 20000037804; Copyright Waived; Avail: CASI; A02, Hardcopy

Many nations today face the choice between procuring new aircraft or upgrading their existing fleet aircraft, An upgrade is frequently seen as a cost-effective solution to meet new mission requirements in a timely fashion. An upgrade allows the user to capitalize on technological advances since the development of the basic airframe. A key aspect of any aircraft program, whether an upgrade or an initial development, is the flight test phase. Flight test is the final stage where the new capabilities are evaluated for their likelihood to deliver added utility to the war fighter. However, given an avionics upgrade for a proven aircraft system, such as the F-16, the need for a flight test program is often questioned. 'After all, it is only software' is a common comment. This paper will explore the need for, and benefits of, flight test in upgrade programs. It will address the economics of testing, examine the limitations of upgrades, and touch on issues of incorporating new technology into existing weapon systems. Examples and lessons learned from actual programs either tested or currently under test at the 416th Flight Test Squadron, Edwards AFB, California will be incorporated. These flight test lessons can be easily applied to other procurement programs.
Author
Upgrading; Flight Tests; Avionics

20000037818 Boeing Co., Mesa, AZ USA
THE AH-64D APACHE LONGBOW: AFFORDABLE EVOLUTION
Dimmery, Hugh M., Boeing Co., USA; Advances in Vehicle Systems Concepts and Integration; April 2000, pp. A22-1 - A22-3; In English; See also 20000037804; Copyright Waived; Avail: CASI; A01, Hardcopy

The US Army and Boeing Rotorcraft are enhancing the capabilities that made the AH-64A Apache the best attack helicopter in the world. These enhancements are resulting in the most capable, fully integrated, combat weapons platform for the twenty-first century: the AH-64D Apache Longbow. The Apache was the result of the requirement for an advanced attack helicopter. In the early 1970s the US Army decided to replace its AH-I Cobra fleet based on lessons learned from its history (Vietnam), and an analysis of its primary threat, the former Warsaw Pact. The Army's concept was to use 'massed forces for massed effects.' New technologies enabling

standoff weapons employment; the ability to perform multiple target engagements; and night operations capabilities were combined with redundant systems; ballistically tolerant components; and a crashworthy airframe and cockpit resulting in the AH-64A. The AH-64A entered service in 1986 with the US Army and later with five international defense forces (Israel, Egypt, Saudi Arabia, the United Arab Emirates, and Greece). In the Army's endeavor to field a twenty-first century platform, the AH-64A Apache provides the basic airframe; and all the basic survivability features that make it a great, survivable aircraft are retained. Boeing is digitizing the combat proven AH-64A Apache. Using 'state-of-the-art' technology, the AH-64D now merges sensor inputs; generates mission data; generates graphical displays (a picture is worth a thousand words); and manages a wealth of information resulting in a totally integrated weapons platform.
Derived from text
Ah-64 Helicopter; Design Analysis; Aircraft Structures

20000037819 Georgia Tech Research Inst., Aerospace and Transportation Lab., Smyrna, GA USA
MH-53J SERVICE LIFE EXTENSION PROGRAM: A SPECIAL OPERATIONAL FORCES ROTORCRAFT WINNER
Crawford, Charles C., Georgia Tech Research Inst., USA; Mason, Henry, Warner Robins Air Logistics Center, USA; Advances in Vehicle Systems Concepts and Integration; April 2000, pp. A23-1 - A23-12; In English; See also 20000037804; Copyright Waived; Avail: CASI; A03, Hardcopy

This paper presents a summary of the air vehicle modifications (largely structural) that were made and the airworthiness qualification flight test program that was conducted to expand the operational gross weight capability and enhance the structural integrity of the subject helicopter. The impact on both vibration and dynamic component retirement times are discussed. The paper includes both technical and cost information to support program benefits of this modernization approach, but will address only the basic air vehicle, including its rotor/drive and propulsion systems. Discussion of special mission equipment peculiar to the special operational forces mission and most shipboard operations features, can not be included.
Author
Service Life; Rotary Wing Aircraft; Aircraft Reliability

20000037820 National Defence Headquarters, Directorate of Technical Airworthiness, Ottawa, Ontario Canada
THE CANADIAN AIR FORCE EXPERIENCE: SELECTING AIRCRAFT LIFE EXTENSION AS THE MOST ECONOMICAL SOLUTION
Landry, Normand, National Defence Headquarters, Canada; Advances in Vehicle Systems Concepts and Integration; April 2000, pp. A24-1 - A24-10; In English; See also 20000037804; Copyright Waived; Avail: CASI; A02, Hardcopy

Canada like several other countries has limited resources to trade-in its outdated and ageing fleets for state-of-the-art weapon systems. With the CFl88 and the CP140, the Canadian Forces (CF) have chosen, as with the CFl16 before, to perform a structural and systems upgrade. These upgrades will allow the aircraft to meet their operational requirements until the first quarter of the next century. The choice for this course of action is based on option analysis studies. In the end, fleet modernization has proven to be the most economical solution. This paper will present the approach taken and the assumptions made for the various scenarios studied to reach that conclusion. Avionics packages are readily available off-the-shelf and in most cases the decision is based mostly on structural limitations. Hence in-service failures and results of full scale fatigue tests obtained through collaborative agreements can be a cost effective way to determine the cost of ownership of each fleet. The paper will briefly talk about the concept taken for the CP140 but will use the CF188 as the demonstration test case.
Author
Life (Durability); Aircraft Structures; Upgrading

20000037821 DaimlerChrysler Aerospace A.G., Manching, Germany
TRANSALL C-160 LIFE EXTENSION AND AVIONICS UPGRADE PROGRAMS
Blumschein, P., DaimlerChrysler Aerospace A.G., Germany; Advances in Vehicle Systems Concepts and Integration; April 2000, pp. A26-1 - A26-5; In English; See also 20000037804; Copyright Waived; Avail: CASI; A01, Hardcopy

Since 1967 the Transall C-160 is the transport aircraft of the German Air Force. After carrying out of life extension measures, avionics upgrade and other improvements of the technical equipment, the Transall C-160 can be operated under economical conditions far beyond 2010. Life extension measures for C-160 started in 1984 (LEDA I and LEDA II). These measures were only carried out for the wings. After taking apart the aircraft in this high scope, more than 30% of complaints were discovered in comparison to the normal preventive maintenance activities. As a result an investigation of aircraft areas and zones not yet subject to inspection measures (PUNIB) was carried out. PUNIB was the basis for LEDA III. In LEDA III the whole structure of the aircraft was inspected. In this manner the life time of the aircraft was extended step by step. Primarily the specification of the original air frame lifetime was restricted to 1995 or 8000 flights (LEDA I, LEDA II). After LEDA III the lifetime for C-l60 was extended to 2010 or 12000 flights. Because of the spare part situation avionic upgrades in 1987 and the replacement of the flight management system (FMS) and the flight control/flight director system (FCS) in 1993 in combination with the replacement of the wiring was carried out. These measures will be finished in 1999. Over and above, the replacement of the intercom system, the improvement of the self defense suite and the integration of a traffic alert and collision avoidance system (TCAS II) as well as other technical measures will be taken. These increase the reliability and improve the precision of the mission management. Moreover the spare part situation was improved since the mid 80's by the aircraft update programmes.
Author
Life (Durability); Upgrading; C-160 Aircraft

20000037822 Eurocopter France, Marseille, France
THE COUGAR C.SAR: AN EXAMPLE OF OPTIMIZATION OF AN EXISTING HELICOPTER *[LE COUGAR C.SAR, UN EXEMPLE D'OPTIMISATION D'UN HELICOPTERE EXISTANT]*
Cabrit, P., Eurocopter France, France; Jaillet, P., Eurocopter France, France; Giacino, T., Eurocopter France, France; Advances in Vehicle Systems Concepts and Integration; April 2000, pp. A27-1 - A27-4; In French; See also 20000037804; Copyright Waived; Avail: CASI; A01, Hardcopy

The COUGAR is a military transport helicopter in the 9-ton class which is primary used in various versions by many armies worldwide (45 client countries). Since this helicopter was launched, EUROCOPTER has consistently developed improvements to this apparatus so that its users may benefit from the most up-to-date equipment on the market while retaining its fundamental military qualities. A special effort was made to provide a very high-performance apparatus for the 'SAR' (*) combat mission.
Derived from text
F-9 Aircraft; Military Helicopters

20000037823 Woodall (David), Fairfax, VA USA
TECHNICAL EVALUATION REPORT
Woodall, David, Woodall (David), USA; Advances in Vehicle Systems Concepts and Integration; April 2000, pp. TB-1 - TB-5; In English; See also 20000037804; Copyright Waived; Avail: CASI; A01, Hardcopy

The Systems Concepts and Integration Panel (SCIP) Joint symposium on Advances In Vehicle Systems Concepts and Integration was held in Ankara, Turkey from 26 to 28 April 1999. Symposium (A) Aircraft Update Programmes, The Economical Alternative? Is reported separately. Symposium (B) Warfare Automation Procedures and Techniques for Unmanned Vehicles, reported on here, was the continuation of a series of symposia initially addressing unmanned tactical air vehicles (UTAs) and more recently broadened to include other forms of unmanned vehicles (UVS). The potential importance of UTAs to NATO was identified in the Advisory Group for Aerospace Research & Development (AGARD) Aerospace 2020 report and addressed during two symposia during 1997. Many of the concepts of interest, potential system elements and their performance, and issues associated with the development of UTA capabilities were initially addressed during the earlier symposia. This

symposium provided an update on progress in these areas and other forms of UVs.
Derived from text
Conferences; North Atlantic Treaty Organization (NATO); Research And Development; Economics; Aeronautical Engineering

20000037825 Dassault Aviation, Technical Systems Dept., Saint-Cloud, France
UNMANNED FIGHTER PLANES (UCAV): THE VIEWPOINT OF AN AIRFRAME DESIGNER *[LES AVIONS DE COMBAT NON HABITES (UCAV): LE POINT DE VUE D'UN AVIONNEUR]*
Condroyer, Daniel, Dassault Aviation, France; Helie, Pierre, Dassault Aviation, France; Advances in Vehicle Systems Concepts and Integration; April 2000, pp. B2-1 - B2-6; In French; See also 20000037804; Copyright Waived; Avail: CASI; A02, Hardcopy

After discussing the context of growing interest in promoting the development of unmanned planes, the article will first demonstrate how, following a first step devoted to offsetting the operator in order to free it from the latter's limitations (such as endurance)-a step which takes the form of systems at the demonstration and operation levels-it is possible to plan for innovation concepts in unmanned fighter planes integrated into complex devices which will meet users' criteria (cost, lethality, flexibility, availability, attrition). Secondly, on the basis of work performed along these lines by Dassault Aviation, the article discusses the techniques and technologies considered necessary for implementing these devices in terms of perception, control, man/system interaction.
Derived from text
Airframes; Design Analysis; Pilotless Aircraft

20000037826 Turkish Land Forces Command, Technical and Project Management Dept., Ankara, Turkey
UAV REQUIREMENTS AND DESIGN CONSIDERATION
Torun, Erdal, Turkish Land Forces Command, Turkey; Advances in Vehicle Systems Concepts and Integration; April 2000, pp. B4-1 - B4-8; In English; See also 20000037804; Copyright Waived; Avail: CASI; A02, Hardcopy

This paper deals with the UAV requirements based on the battlefield experiences. UAV roles in tactical areas and constraints which affect the UAV mission to be conducted are explained and suggestions are given. Constraints: such as environmental conditions, effects on UAV missions, battlefield situations, operational restrictions and technological limits are overviewed. Based on the current applications and systems, some remarks are presented. Considering the future requirements: air vehicle performance data link and expected payload specifications for a general UAV system are addressed. Assessments and recommendations are given for system design consideration.
Derived from text
Pilotless Aircraft; Systems Engineering; Reconnaissance

20000037840 Atlas Elektronik G.m.b.H., Bremen, Germany
UNMANNED AIR VEHICLES FOR THE ARMY: FUTURE CONCEPTS
Baeker, Joachim, Atlas Elektronik G.m.b.H., Germany; Grobecker, Helmut, Atlas Elektronik G.m.b.H., Germany; Hastedt, Ralf, Atlas Elektronik G.m.b.H., Germany; Advances in Vehicle Systems Concepts and Integration; April 2000, pp. B20-1 - B20-7; In English; See also 20000037804; Copyright Waived; Avail: CASI; A02, Hardcopy

The micro drones are not considered in this report because the required technologies and special branches have to be applicated with partly completely new attempts and approaches. As examples for this statement I will mention only the aerodynamics, the microelectronics and micromechanics as well as bio-chemical sensors and neuronal intelligent structures. The way shown here to future UAV systems goes ahead from of the existing and in near future developed technologies for tactical UAV systems and demonstrates about application variants the direction towards far-reaching UAV systems with NATO compatibility.
Derived from text
Pilotless Aircraft; Defense Program; Drone Vehicles; Aerodynamics; Micromechanics; Smart Structures; Microelectronics

20000037844 Lockheed Martin Tactical Aircraft Systems, Fort Worth, TX USA
UCAV CONCEPTS FOR CAS
Chaput, Armand, Lockheed Martin Tactical Aircraft Systems, USA; Henson, Ken C., Lockheed Martin Tactical Aircraft Systems, USA; Ruszkowski, Robert A., Jr., Lockheed Martin Tactical Aircraft Systems, USA; Advances in Vehicle Systems Concepts and Integration; April 2000, pp. B27-1 - B27-12; In English; See also 20000037804; Copyright Waived; Avail: CASI; A03, Hardcopy

A system concept is described that would give individual combat users access to and (limited) control of a network of unmanned air vehicles. Applications would be both lethal and nonlethal. In the nonlethal form, unmanned combat air vehicles could respond to fire support requests as if they were the virtual equivalent of organic, long-range artillery. In the nonlethal form, unmanned reconnaissance air vehicles could point their sensors at locations and/or areas of interest and respond with target imagery or coordinates of selected target types. Capabilities currently exist to evaluate these concepts in simulated or actual field trials and/or to develop an initial operating capability (IOC).
Derived from text
Combat; Pilotless Aircraft; Aerial Reconnaissance; Systems Engineering

20000037888 European Unmanned Vehicle Systems Association, Paris, France
UAVS: CURRENT SITUATION AND CONSIDERATIONS FOR THE WAY FORWARD
vanBlyenburgh, Peter, European Unmanned Vehicle Systems Association, France; Development and Operation of UAVs for Military and Civil Applications; April 2000, pp. 1-1 - 1-27; In English; See also 20000037887; Copyright Waived; Avail: CASI; A03, Hardcopy

This document will try to give the reader an overview of the current situation pertaining to unmanned aerial vehicle (UAV) systems in the world and it is will endeavour to give some indications on what the future may have in store for us. It does not have the pretention of being complete and covering everything going on in this field in every country, but rather it will try to give a representative overview of the UAVs currently in use, being considered for purchase and the general state of UAV-related technology and the industry involved.
Derived from text
Pilotless Aircraft; Remote Control; Range; Endurance

20000037892 Defence Procurement Agency, Bristol, UK
DESIGN AND AIRWORTHINESS REQUIREMENTS FOR MILITARY UNMANNED AIR VEHICLE SYSTEMS
Rogers, Bernard C., Defence Procurement Agency, UK; Development and Operation of UAVs for Military and Civil Applications; April 2000, pp. 4-1 - 4-14; In English; See also 20000037887; Copyright Waived; Avail: CASI; A03, Hardcopy

This paper examines the safety implications and factors to be considered for the procurement of a UAV and identities the design requirements to be used as a guide to produce an air vehicle specification. It will touch on matters covered in more detail by other presenters because of the need to reflect the information they provide within the new standard. It should be noted that while appreciating that dirigibles and micro UAV#s will be introduced in the future, it was agreed that the current UK Defence Standard 00-970 should comply with current policy agreed within the UK (UK) Ministry of Defence (MOD), and that by the Civil Aviation Authority (CAA), which is, that UAV Systems under 20kgs should be treated as models and as such do not need to comply with the regulations governing aircraft. This paper also identifies the role of the 'Airworthiness, Design Requirements and Procedures (ADRP) organisation' of the UK MOD Defence Procurement Agency (DPA) and details the work being carried out in developing a set of general design and airworthiness requirements for UAV systems. ADRP are part of the new Defence Procurement Agency (DPA). which was formed on the 1st of April 1999, to take forward the 'SMART' Procurement initiative, which aims to use faster, cheaper and better ways of equipping the UK armed forces. This involves Integrated Project Teams (IPT) managing the programmes throughout the life of the equipment. This paper discusses the current and future UAV Systems requirements and gives a brief insight into the strategy adopted to produce a set of regulatory documents and procedures for the guidance of the MOD Integrated Project Team leader (IPT/L). This is done by ensuring adequate procedures are in place for the safe and airworthy operation of such aircraft. These procedures set the minimum standard required to accommodate the safe operation of all UAV systems in all

airspace conditions subject to any limitations and constraints imposed by the design.
Author
Aircraft Reliability; Pilotless Aircraft; Aircraft Design; Safety Factors; Airships

20000037895 Georgia Tech Research Inst., Atlanta, GA USA
MICROFLYERS AND AERIAL ROBOTS: MISSIONS AND DESIGN CRITERIA
Michelson, Robert C., Georgia Tech Research Inst., USA; Development and Operation of UAVs for Military and Civil Applications; April 2000, pp. 7-1 - 7-13; In English; See also 20000037887; Copyright Waived; Avail: CASI; A03, Hardcopy

This paper provides an overview of the issues surrounding the design and choice of appropriate missions for a new class of unmanned flying vehicles known as MicroFlyers, Micro Air Vehicles, and Aerial Robots. These terms are often used interchangeably to refer to small flying machines varying from what amounts to 'intelligent dust' up to vehicles in the size range of small radio-controlled models (i.e., having a typical maximum dimension of one meter). Because of the size of this class of air vehicle, it can engage in missions that are non-traditional, such as indoor flight through confined spaces, or en mass, to overwhelm a target in swarms. Also because of size, many of these vehicles will have to be autonomous. In some cases, the design of the vehicle will benefit from biological mimicry wherein the behavioral and locomotive techniques used by birds and insects will be of advantage. However, the small size of these air vehicles will also constrain them in the physical environment in much the same way that insects are not necessarily free to navigate at will in the presence of wind and precipitation.
Author
Aircraft Design; Design Analysis; Robots; Pilotless Aircraft

20000037897 Royal Military Academy, Brussels, Belgium
VARIOUS SENSORS ABOARD UAVS
Schweicher, E. J., Royal Military Academy, Belgium; Development and Operation of UAVs for Military and Civil Applications; April 2000, pp. 10-1 - 10-72; In English; See also 20000037887; Copyright Waived; Avail: CASI; A04, Hardcopy

In order to deal with all possible UAV imaging sensors, we better choose the example of a recently introduced UAV: the General Atomics Predator UAV. The Predator sensor payload includes an q (Electra-Optical) suite, a Ku-band SAR sensor, Ku-band and UHF-band satellite communications (SATCOM), a C-band light-of-sight data link, and a GPS/INS navigator. The Predator's SAR sensor is the Northrop Grumman (Westinghouse) Tactical Endurance Synthetic Aperture Radar (TESAR). TESAR provides continuous, near real time strip-map transmitted imagery over an 800 meter swath at slant ranges up to 11km. Maximum data rate is 500,000 pixels per second. The target resolution is 0.3meters. TESAR weight and power consumption are 80kg and 1200W respectively. A lighter weight, lower cost SAR is currently in development for Predator. The Predator's EO sensor suite is the VERSATRON Skyball SA-144/18 quartet sensor. It consists of a PtSi 512x512 MWIR (Mid Wave IR) FLIR with six fields of view (to easily perform either detection or recognition or identification), a color TV camera with a 10X zoom, a color TV 9OOmm camera and an eyesafe pulsed Er: glass laser rangefinder (this Er: glass laser could advantageously be replaced by an eyesafe Er: YAG laser because YAG is a better heat sink than glass enabling a higher efficiency). The diameter of the EO sensor turret is relatively small-35cm. The turret has precision pointing with a line-of-sight stabilization accuracy of 10 microrad. It is anticipated that high performance UAV's of the year 2010 will have a broad range of missions, including surveillance, reconnaissance, communication , intelligence gathering of threat electronic emissions, target designation for weapons attacking moving targets, and communication relay.
Author
Synthetic Aperture Radar; Satellite Communication; Payloads; Laser Range Finders; Imaging Techniques; Flir Detectors; Communication Satellites

20000037899 Notre Dame Univ., Dept. of Aerospace and Mechanical Engineering, IN USA
AERODYNAMIC MEASUREMENTS AT LOW REYNOLDS NUMBERS FOR FIXED WING MICRO-AIR VEHICLES
Mueller, Thomas J., Notre Dame Univ., USA; Development and Operation of UAVs for Military and Civil Applications; April 2000, pp. 8-1 - 8-32; In English; See also 20000037887; Copyright Waived; Avail: CASI; A03, Hardcopy

A description of the micro-air vehicle (MAV) concept and design requirements is presented. These vehicles are very small and therefore operate at chord Reynolds numbers below 200,000 where very little data is available on the performance of lifting surfaces, i.e., airfoils and low aspect-ratio wings. This paper presents the results of a continuing study of the methods that can be used to obtain reliable force and moment data on thin wings in wind and water tunnels. To this end, a new platform force and moment balance, similar to an already existing balance, was designed and built to perform lift, drag and moment measurements at low Reynolds numbers. Balance characteristics and validation data are presented. Results show a good agreement between published data and data obtained with the new balance. Results for lift, drag and pitching moment about the quarter chord with the existing aerodynamic balance on a series of thin flat plates and cambered plates at low Reynolds numbers are presented. They show that the cambered plates offer better aerodynamic characteristics and performance. Moreover, it appears that the trailing-edge geometry of the wings and the turbulence intensity up to about 1% in the wind tunnel do not have a strong effect on the lift and drag for thin wings at low Reynolds numbers. However, the presence of two endplates for two-dimensional tests and one endplate for the semi-infinite tests appears to have an undesirable influence on the lift characteristics at low Reynolds numbers. The drag characteristics for thin flat-plate wings of aspect ratio greater than one do not appear to be affected by the endplates. The effect of the endplates on the drag characteristics of cambered-plate wings is still under investigation. It is known, however, that endplates do have an effect on the drag and lift characteristics of a cambered Eppler 61 airfoil/wing.
Author
Fixed Wings; Aerodynamic Characteristics; Low Reynolds Number; Pilotless Aircraft; Aerodynamic Drag; Drag Measurement

20000047291 Dassault Aviation, Saint-Cloud, France
TECHNOLOGY TRENDS FOR FUTURE BUSINESS JET AIRFRAME
Rouquet, A., Dassault Aviation, France; Chaumette, D., Dassault Aviation, France; New Metallic Materials for the Structure of Aging Aircraft; April 2000, pp. 3-1 - 3-4; In English; See also 20000047290; Original contains color illustrations; Copyright Waived; Avail: CASI; A01, Hardcopy

Today's aerospace market is extremely tough; the constant quest for reduced production cost in existing airframes may provide an opportunity for introducing new technologies through re-engineering of structural component. This paper highlights the approach used at Dassault Aviation for the Falcon business jet family. Within the technologies patchwork, choices and solutions are reviewed and discussed using examples.
Author
Technology Assessment; Cost Reduction; Aerospace Industry

20000047292 Defence Evaluation Research Agency, Mechanical Sciences Sector, Farnborough, UK
FUTURE ALUMINIUM TECHNOLOGIES AND THEIR APPLICATION TO AIRCRAFT STRUCTURES
Borradaile, J. B., Defence Evaluation Research Agency, UK; New Metallic Materials for the Structure of Aging Aircraft; April 2000, pp. 4-1 - 4-4; In English; See also 20000047290; Copyright Waived; Avail: CASI; A01, Hardcopy

Aluminium remains a predominant material for airframes. Carbon fibre composites and titanium alloys have made in roads especially in some military airframes such as Typhoon and Tornado. However with affordability now having equal emphasis to the classical performance requirements in aircraft design, such as speed. range, payload and stealth, aluminium could soon recover some of these applications. Aerospace manufacturers are giving significant attention to developments in the areas of new aluminium materials, low cost manufacturing and unitized structures. The latter is because the cost of producing aircraft is being driven by the cost of assembly which drives production towards fewer, cheaper-to-assemble parts, whilst maintaining close tolerance in manufacture.
Author
Aluminum; Technology Assessment; Aircraft Structures; Airframes; Carbon Fibers; Fiber Composites; Titanium Alloys

20000053158 DaimlerChrysler Aerospace A.G., Military Aircraft MT24, Munich, Germany
A UNIQUE DESIGN FOR A DIVERGING FLEXIBLE VERTICAL TAIL
Sensburg, O., DaimlerChrysler Aerospace A.G., Germany; Schneider, G., DaimlerChrysler Aerospace A.G., Germany; Tischler, V., Wright Lab., USA; Venkayya, V., Wright Lab., USA; Structural Aspects of Flexible Aircraft Control; May 2000, pp. 1-1 - 1-17; In English; See also 20000053157; Copyright Waived; Avail: CASI; A03, Hardcopy

A method is developed which allows to use the flexible behaviour of aircraft structures to enhance aerodynamic derivatives. A vertical tail analytical model was used to show these effects and by exploiting the aeroelastic deflections it is possible to reduce the area of this surface up to thirty percent. Numerous applications are possible including fighter and transport airplanes. Since composite structures are involved it is absolutely necessary to use a multidisciplinary optimisation program code such as the US-Airforce ASTROS-code.
Author
Aircraft Design; Tail Assemblies; Applications Programs (Computers); Flexible Bodies; Dynamic Structural Analysis; Aeroelasticity

20000053159 Lockheed Martin Tactical Aircraft Systems, F-22 Structural Dynamics, Fort Worth, TX USA
F-22 STRUCTURAL COUPLING LESSONS LEARNED
Wray, William R., Jr., Lockheed Martin Tactical Aircraft Systems, USA; Structural Aspects of Flexible Aircraft Control; May 2000, pp. 2-1 - 2-9; In English; See also 20000053157; Copyright Waived; Avail: CASI; A02, Hardcopy

A survey of current F-22 aeroservoelastic analysis and testing activity shows that valuable insight has been gained into several structural coupling and ride quality problems. The aeroservoelastic (ASE) analysis results agree well with flight and ground test measurements. Examples from a recent structural coupling test will be used to illustrate some recent F-22 ASE issues.
Author
Aeroservoelasticity; F-22 Aircraft; Dynamic Structural Analysis; Flight Control; Control Systems Design; Loop Transfer Functions

20000053160 Boeing Phantom Works, Long Beach, CA USA
AEROSERVOELASTIC MODELING, ANALYSIS, AND DESIGN TECHNIQUES FOR TRANSPORT AIRCRAFT
Baker, Myles L., Boeing Phantom Works, USA; Goggin, Patrick J., Boeing Phantom Works, USA; Winther, Bertil A., Boeing Phantom Works, USA; Structural Aspects of Flexible Aircraft Control; May 2000, pp. 3-1 - 3-6; In English; See also 20000053157; Copyright Waived; Avail: CASI; A03, Hardcopy

Piloted and batch simulations of the aeroservoelastic response of flight vehicles are essential tools in the development of advanced flight control systems. In these simulations the number of differential equations must be sufficiently large to yield the required accuracy, yet small enough to enable real-time evaluations of the aircraft flying qualities and rapid batch simulations for control law design. The challenge of these conflicting demands is made especially difficult by the limited accuracy of the analytical modeling techniques used, nonlinearities in the quasi-steady equations of motion and by the complex characteristics of the unsteady aerodynamic forces. In this paper, a brief survey of some of the techniques that have been used at Boeing to develop aeroservoelastic math models for control system design and evaluation are presented, along with a discussion of the strengths and weaknesses of the various techniques. The modeling techniques discussed include frequency response fitting methods, rational function approximation methods, and the P-Transform technique. Integration of the aeroservoelastic structural dynamic model with a nonlinear flight simulation is also discussed.
Author
Aeroservoelasticity; Control Systems Design; Control Theory; Dynamic Models; Mathematical Models

20000053162 Alenia Aeronautica, Aircraft Engineering, Turin, Italy
GROUND STRUCTURAL COUPLING TESTING AND MODEL UPDATING IN THE AEROSERVOELASTIC QUALIFICATION OF A COMBAT AIRCRAFT
Vaccaro, V., Alenia Aeronautica, Italy; Caldwell, B., British Aerospace Aircraft Group, UK; Becker, J., Daimler-Benz Aerospace A.G., Germany; Structural Aspects of Flexible Aircraft Control; May 2000, pp. 5-1 - 5-12; In English; See also 20000053157; Copyright Waived; Avail: CASI; A03, Hardcopy

This paper is concerned with the role played by the ground Structural Coupling Test (SCT) and the update of the aeroservoelastic model in the qualification process of a modern combat aircraft. It represents the completion of Reference 1, after several improvements introduced in the Notch Filter (NF) design procedure, numerous ground test campaigns and the confirmation of flight trials. Most of modern combat aircraft are equipped with fly-by-wire and digital flight control systems (FCS). The problem of interaction between the dynamic response of the airframe and the FCS is usually solved through an appropriate set of notch filters, designed to attenuate the level of structure vibrations picked up by the FCS sensors. Fundamental part of the qualification of the notch filter set is the ground testing activity, generally known as ground Structural Coupling Test. The main subjects of this paper are: (1) Test Procedure; (2) Model update; and (3) Describe how ground test data is used to augment model predictions in areas where the model on its own is not considered adequate for notch filter design.
Author
Aeroservoelasticity; Fighter Aircraft; Flight Control; Ground Tests; Aircraft Structures; Structural Vibration; Control Systems Design

20000053163 Olsen Engineering Consulting, Dayton, OH USA
UNIFIED FLIGHT MECHANICS AND AEROELASTICITY FOR ACCELERATING, MANEUVERING, FLEXIBLE AIRCRAFT
Olsen, James J., Olsen Engineering Consulting, USA; Structural Aspects of Flexible Aircraft Control; May 2000, pp. 6-1 - 6-12; In English; See also 20000053157; Copyright Waived; Avail: CASI; A03, Hardcopy

This paper reveals new insights in the aeroelasticity and flight mechanics of flexible aircraft by obtaining and solving the equations of motion for a flexible, accelerating, rotating aircraft. We illustrate the approach for three cases of increasing complexity: The first cast is a 'sprung' pendulum. It shows when rigid body angular velocities can be important in the flexibility equations as they approach as the flexible frequencies. The second case is a typical section airfoil on an accelerating, rotating fuselage. It applies Lagrange's equations to a longitudinal problem in inertial coordinates, then transforms the equations to noninertial, body-fixed coordinates for solution. It also shows when rigid body rotations and longitudinal accelerations must be included in the flexibility equations. The third case is the general longitudinal/lateral motion of an accelerating, rotating, flexible vehicle. Rather than setting up the general problem in inertial coordinates and then transforming to body-fixed coordinates, instead we use the idea of 'quasi-coordinates'. We establish a general form for Lagrange's equations in the noninertial, body-fixed coordinates. The paper gives the general equations and reduces them to a special case of a 'flat' airplane. It also gives guidelines as to when the rigid body rotations and accelerations are important factors in the flexibility equations.
Author
Flight Mechanics; Aeroelasticity; Acceleration (Physics); Rigid Structures; Rotating Bodies; Euler-Lagrange Equation; Mathematical Models; Coordinate Transformations

20000053164 Daimler-Benz Aerospace A.G., Military Aircraft, Munich, Germany
AN INTEGRATED DESIGN PROCEDURE FOR AIRCRAFT STRUCTURE INCLUDING THE INFLUENCE OF FLIGHT CONTROL SYSTEM ON AIRCRAFT FLUTTER
Luber, W., Daimler-Benz Aerospace A.G., Germany; Becker, J., Daimler-Benz Aerospace A.G., Germany; Structural Aspects of Flexible Aircraft Control; May 2000, pp. 7-1 - 7-15; In English; See also 20000053157; Copyright Waived; Avail: CASI; A03, Hardcopy

Modern fighter aircraft are using high sophisticated power control and automatic flight control systems, which basically are designed to maneuver the airplane and to provide sufficient damping for the rigid body modes. Since the sensors are attached to the flexible structure, motions of the elastic aircraft will be measured and may influence the control system. In order to avoid instabilities it is necessary to predict the response of the aircraft with the control system and to correlate with flight test data. An analytical approach for the complete system including flight mechanics and unsteady aerodynamic forces is presented. The elastic structure is described

by a set of normal modes which have been updated by results of ground resonance survey tests. Flutter calculations in open and closed loop on different flight conditions as well as incidence variations are demonstrated as common flutter plots. For the flutter analysis a set of notch filter is required, which should be determined in an integrated design step.
Author
Control Systems Design; Flight Mechanics; Flight Control; Flutter Analysis; Aeroservoelasticity; Mathematical Models; Dynamic Models

20000053165 Manchester Univ., School of Engineering, UK
CHARACTERISATION OF NONLINEAR AEROSERVOELASTIC BEHAVIOUR
Dimitriadis, G., Manchester Univ., UK; Cooper, J. E., Manchester Univ., UK; Structural Aspects of Flexible Aircraft Control; May 2000, pp. 8-1 - 8-11; In English; See also 20000053157; Copyright Waived; Avail: CASI; A03, Hardcopy

The characterisation of the behaviour of nonlinear aeroelastic systems has become a very important research topic. Nevertheless, most of the work carried out to date concerns the development of unsteady CFD solutions in the transonic region. Important though this work is, there is also a need for research which aims at understanding the behaviour of nonlinear systems, particularly the occurrence of Limit Cycle Oscillations (LCOs). The purpose of this paper is to study the stability of a simple aeroservoelastic system with nonlinearities in the control system. The work considers both structural and control law nonlinearities and assesses the stability of the system response by use of bifurcation diagrams. It is shown that simple feedback systems designed to increase the stability of the linearized system also stabilise the nonlinear system, although their effects can be less pronounced. Additionally, a nonlinear control law designed to limit the control surface pitch response was found to increase the flutter speed considerably by forcing the system to undergo limit cycle oscillations instead of fluttering. Finally, friction was found to affect the damping of the system but not its stability, as long as the amplitude of the frictional force is low enough not to cause stoppages in the motion.
Author
Aeroservoelasticity; Flutter; Nonlinear Systems; Control Systems Design; Systems Stability; Aircraft Control

20000053168 Air Force Research Lab., Wright-Patterson AFB, OH USA
THE IMPACT OF ACTIVE AEROELASTIC WING TECHNOLOGY ON CONCEPTUAL AIRCRAFT DESIGN
Flick, Peter M., Air Force Research Lab., USA; Love, Michael H., Lockheed Martin Tactical Aircraft Systems, USA; Structural Aspects of Flexible Aircraft Control; May 2000, pp. 10-1 - 10-10; In English; See also 20000053157; Copyright Waived; Avail: CASI; A02, Hardcopy

Active Aeroelastic Wing (AAW) Technology represents a new design approach for aircraft wing structure. The technology uses static aeroelastic deformations as a net benefit during maneuvering. AAW is currently being matured through a flight research program; however, transition of the technology to future systems will require educating designers in multiple disciplines on this new design approach. In order to realize the full benefits of AAW, aeroelastic effects will need to be accounted for from the beginning of the design process. Conceptual design decisions regarding wing aspect ratio, wing thickness-to-chord ratio. and wing torque box geometry will be influenced if designers choose to utilize AAW. This paper will present current work in developing conceptual aircraft design guidance for AAW and identify improvements to the design process that could facilitate future AAW design applications. This process involves using results from aeroelastic design methods, typically used in preliminary design, with conventional conceptual design methods. This approach will allow aeroelastic effects to be accounted for while making conceptual design decisions.
Author
Aeroelasticity; Aircraft Design; Aircraft Structures; Aeroelastic Research Wings

20000053169 DaimlerChrysler Aerospace A.G., Military Aircraft, Munich, Germany
ACTIVE AEROELASTIC AIRCRAFT AND ITS IMPACT ON STRUCTURE AND FLIGHT CONTROL SYTSEMS DESIGN
Schweiger, Johannes, DaimlerChrysler Aerospace A.G., Germany; Krammer, Johann, DaimlerChrysler Aerospace A.G., Germany; Structural Aspects of Flexible Aircraft Control; May 2000, pp. 11-1 - 11-8; In English; See also 20000053157; Copyright Waived; Avail: CASI; A02, Hardcopy

Active aeroelastic concepts have been proposed for several years now. Their common incentive are improvements of aircraft performance and stability by the intentional use of aeroelastic effects. This means that the basic flexibility characteristics of a new aircraft project must be included in the early conceptual design process, and the structural and flight control system design must be coupled very closely. The knowledge about the magnitude of aeroelastic impacts on aerodynamic forces and aircraft stability is still very limited within the community of people involved in aeronautical engineering - even among the specialists in aeroelasticity. For a successful application of active aeroelastic concepts, their proper identification is therefore the first step. It will be shown for some selected examples, which static aeroelastic effects are usually very important for conventional designs, and how they can be made even more effective in a positive sense for future designs. The accuracy and proper use of aeroelastic prediction methods and analysis models is addressed briefly in the context of interactions with other disciplines, and ideas are developed for the multi-disciplinary design process of active aeroelastic aircraft concepts. Whereas static aeroelastic effects usually only become important with increasing airspeed, a concept will be demonstrated for aeroelastic improvements, which also works at low speeds.
Author
Aircraft Design; Control Systems Design; Flight Control; Aircraft Structures; Aeroelasticity; Active Control

20000053170 Northrop Grumman Corp., Military Aircraft Systems Div., Pico Rivera, CA USA
AEROSERVOELASTIC CHARACTERISTICS OF THE B-2 BOMBER AND IMPLICATIONS FOR FUTURE LARGE AIRCRAFT
Britt, R. T., Northrop Grumman Corp., USA; Volk, J. A., Northrop Grumman Corp., USA; Dreim, D. R., Northrop Grumman Corp., USA; Applewhite, K. A., Northrop Grumman Corp., USA; Structural Aspects of Flexible Aircraft Control; May 2000, pp. 12-1 - 12-12; In English; See also 20000053157; Copyright Waived; Avail: CASI; A03, Hardcopy

Design and development of the B-2 Bomber presented many challenges in flexible vehicle control, many related to the unique configuration and design requirements, The technical challenges posed by the aeroelastic characteristics of the all-wing aircraft were recognized at the outset of the development program and included the configuration's near-neutral pitch stability and light wing loading which made the aircraft highly responsive to atmospheric turbulence. This dictated the requirement for an active digital flight control system to provide both stability augmentation and gust load alleviation. The gust load alleviation flight control system was designed by a multidisciplinary team using a combination of optimal and classical control design techniques and a common analysis model database. Accurate representation of the vehicle aerodynamics characteristics, actuators, and sensors were key to successfully developing and testing the flight control system and verifying performance requirements. Flight test data analysis included the extraction of the vehicle open loop response which were utilized to adjust the analytical models and make final revisions to control law gains. The multidisciplinary design approach resulted in the successful development of a control augmentation system that provides the B-2 with superb handling characteristics, acceptable low altitude ride quality, and substantial alleviation of gust loads on the airframe. With this back drop, a technology assessment is performed which discusses potential technology improvements for application to future bomber and large transport aircraft.
Author
Active Control; Aeroservoelasticity; Aircraft Design; Control Systems Design; Control Theory; Flight Control; Technology Assessment; B-2 Aircraft

20000053172 Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Inst. of Structural Mechanics, Brunswick, Germany
DESIGN ASPECTS OF THE ELASTIC TRAILING EDGE FOR AN ADAPTIVE WING

Monner, H. P., Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; Sachau, D., Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; Breitbach, E., Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; Structural Aspects of Flexible Aircraft Control; May 2000, pp. 14-1 - 14-8; In English; See also 20000053157; Copyright Waived; Avail: CASI; A02, Hardcopy

According to predictions of market researchers a large growth in numbers of passengers as well as of airfreight volume can be expected for the civil transport aircraft industry. This will lead to an increased competition between the aircraft manufacturers. To stay competitive it will be essential to improve the efficiency of the new aircraft generation. Especially the transonic wings of civil aircraft with their fixed geometry offer a large potential for improvement. Such fixed geometry wings are optimized for only one design point characterized by the parameters altitude, math number and aircraft weight. Since these vary permanently during the mission of the aircraft the wing geometry is only seldom optimal. As aerodynamic investigations have shown one possibility to compensate for this major disadvantage lies in the chordwise and spanwise differential variation of the wing camber for mission duration. This paper describes the design of a flexible flap system for an adaptive wing to be used in civil transport aircraft that allows both a chordwise as well as a spanwise differential camber variation during flight. Since both lower and upper skins are flexed by active ribs, the camber variation is achieved with a smooth contour and without any additional gaps. This approach for varying the wing's camber is designed to be used for replacement and enhancement of a given flap system. In addition the kinematics of the rib structure allows for adaptation of the profile contour to different types of aerodynamic and geometric requirements.

Author

Mission Adaptive Wings; Wing Camber; Trailing Edges; Flexible Wings; Aeroelasticity; Aircraft Control

20000053175 Aerospatiale Matra Airbus, Toulouse, France

PASSENGER COMFORT IMPROVEMENT BY INTEGRATED CONTROL LAW DESIGN

Kubica, Francois, Aerospatiale Matra Airbus, France; Madelaine, Beatrice, Aerospatiale Matra Airbus, France; Structural Aspects of Flexible Aircraft Control; May 2000, pp. 17-1 - 17-4; In English; See also 20000053157; Copyright Waived; Avail: CASI; A01, Hardcopy

This paper presents comfort criteria based on ISO 2631-1 standard, and shows how these criteria can be applied to a large capacity civil aircraft for passenger comfort evaluation. The results obtained show that fly-by-wire allows to improve comfort with respect to the natural aircraft. More over an active control of the fast flexible modes allows not only to improve 'low frequency' comfort (vibrating comfort), but also 'very low frequency' comfort (motion sickness phenomenon). This study defines tools for comfort analysis and control law design, which could be used for future large civil aircraft, like the A340-500/600 and the A3XX.

Author

Active Control; Civil Aviation; Fly By Wire Control; Passenger Aircraft; Riding Quality; Vibration Damping

20000053179 Construcciones Aeronauticas S.A., Structural Dynamics and Aeroelasticity Dept., Madrid, Spain

NON LINEAR EFFECTS OF APPLIED LOADS AND LARGE DEFORMATIONS ON AIRCRAFT NORMAL MODES

Oliver, M., Construcciones Aeronauticas S.A., Spain; Climent, H., Construcciones Aeronauticas S.A., Spain; Rosich, F., Construcciones Aeronauticas S.A., Spain; Structural Aspects of Flexible Aircraft Control; May 2000, pp. 21-1 - 21-12; In English; See also 20000053157; Copyright Waived; Avail: CASI; A03, Hardcopy

Ground Vibration Test (GVT) is the typical way to verify structural dynamic models. The conditions in which the GVT is performed -the aircraft subjected and deformed under gravity loads- are different from the conditions in which the Finite Element Method (FEM) model is usually elaborated (jig shape without loads). They are also different from the in-flight conditions (the aircraft subjected and deformed under inertia and aerodynamic forces). Although in most cases those differences can be negligible, it is not the case of a very large airplane in which the size and flexibility effects are of such nature that updating a FEM model to match GVT results could go in the opposite direction to the actual airplane in-flight. This paper analyses the influence of aircraft deformation (down bending for GVT, jig shape for FEM model, up bending for flight), shape (control surfaces deflections...), and loads (gravity on ground, inertial and aerodynamic forces in flight) on normal modes to have a better insight in GVT and flight test measurements interpretation of a very large airplane. Those effects are significant especially where large concentrated masses (engine-pylon) are present.

Author

Nonlinear Systems; Finite Element Method; Aerodynamic Forces; Aerodynamic Loads; Ground Effect (Aerodynamics); Aircraft Structures; Elastic Deformation; Dynamic Structural Analysis

20000053180 DaimlerChrysler Aerospace Airbus G.m.b.H., Hamburg, Germany

FLIGHT SIMULATION WITHIN THE FRAME OF MULTIDISCIPLINARY OPTIMIZATION OF LARGE FLEXIBLE AIRCRAFT

Rommel, Armin, DaimlerChrysler Aerospace Airbus G.m.b.H., Germany; Structural Aspects of Flexible Aircraft Control; May 2000, pp. 22-1 - 22-8; In English; See also 20000053157; Copyright Waived; Avail: CASI; A02, Hardcopy

The disciplines flight mechanics/flight control and structural dynamics have to work closely together when large flexible aircraft, such as A340-600 and A3XX, are designed. The flight-control system has to be designed under the constraint that structural oscillation resonances or unacceptable levels of structural loads have to be avoided. Especially the integration of flight control and structural control requires multidisciplinary cooperation. In the potential conflict between handling qualities and minimal structural loads requirements the flight-control law parameters have to be optimized. This paper describes enhancements of real-time flight simulation in order to integrate the pilot into the control loop especially with respect to the effects of cockpit accelerations. The enhancements cover the coupling of rigid body motion and flexible modes in order to analyze the effects of neighboring frequencies, as well as the inclusion of simplified loads computation within the real-time simulation environment. Moreover, a cost-effective way of simulation-model development is presented. This covers model development and testing/validation on a fixed-base engineering flight simulator followed by a proven model transfer onto a six degrees of freedom motion simulator where intensive pilot-in-the-loop investigations can be carried out.

Author

Dynamic Structural Analysis; Flexible Wings; Flight Control; Flight Simulation; Multidisciplinary Design Optimization; Mathematical Models

20000061421 Boeing Phantom Works, Air Vehicle Advanced Design, Long Beach, CA USA

THE FUTURE ROLE OF VIRTUAL DESIGN TEAMS

Guthrie, Charlie, Boeing Phantom Works, USA; Aerodynamic Design and Optimisation of Flight Vehicles in a Concurrent Multi-Disciplinary Environment; June 2000, pp. 2-1 - 2-3; In English; See also 20000061419; Copyright Waived; Avail: CASI; A01, Hardcopy

This keynote presentation will discuss the role that our aerospace engineers and their design teams and tools will play in the 'Virtual' design office of the future. Dramatically improving information technology is rapidly changing the design environment and the potential capability of the design toolsets. Along with these improvements in capability, there is a change in our expectations and requirements for both the design teams and the tools that enable the design teams to accomplish their tasks.

Author

Engineers; Information Systems

20000061423 Lockheed Martin Corp., Skunk Works, Palmdale, CA USA

ROLE OF THE AERODYNAMICIST IN A CONCURRENT MULTI-DISCIPLINARY DESIGN PROCESS

Nicolai, Leland M., Lockheed Martin Corp., USA; Carty, Atherton, Lockheed Martin Corp., USA; Aerodynamic Design and Optimisation of Flight Vehicles in a Concurrent Multi-Disciplinary Environment; June 2000, pp. 4-1 - 4-14; In English; See also 20000061419; Copyright Waived; Avail: CASI; A03, Hardcopy

As the affordability of new aircraft and missile systems becomes an essential element of new development programs, the time spent in the early design (conceptual and preliminary design) needs to be reduced. This paper will address the time and activities associated with the conceptual and preliminary design of an aircraft,

the role of the aerodynamicist in this early design period and the tools that he uses. The question of how the design time can be shortened will be discussed and what the aerodynamicist can do about it.
Author
Design Analysis; Time Dependence; Aircraft Design

20000061424 Cranfield Univ., Coll. of Aeronautics, Cranfield, UK
LEARNING THROUGH EXPERIENCE: GROUP DESIGN PROJECTS ON THE MASTERS COURSE IN AIRCRAFT ENGINEERING
Jones, R. I., Cranfield Univ., UK; Scott, R. G., British Aerospace, UK; Aerodynamic Design and Optimisation of Flight Vehicles in a Concurrent Multi-Disciplinary Environment; June 2000, pp. 5-1 - 5-11; In English; See also 20000061419; Copyright Waived; Avail: CASI; A03, Hardcopy

The successful completion of aerospace projects usually involves the bringing together of many different specialist skills. The need for aerospace engineers to be conversant with many disciplines and aware of the many facets of a project is today's reality. However, in today's working environment it is becoming increasingly difficult for individuals to achieve the necessary experience, with the timescales for major aerospace projects getting ever longer and their number decreasing. The Group Design Projects within the Aircraft Engineering course have the specific purpose of addressing this issue. They provide the opportunity for aerospace engineers from a range of disciplines to be involved in a real project, with many of the difficulties and constraints of those they will meet in their working lives. These projects progress through the full design process and provide this experience within a limited time period and, relatively, limited risk environment. In addition to meeting their basic objective, Group Design Projects commenced to-date have proved very demanding but provided further benefits to all concerned.
Author
Flat Surfaces; Design Analysis; Education

20000061425 Pisa Univ., Dept. of Aerospace Engineering, Italy
AN OPTIMISATION PROCEDURE FOR THE CONCEPTUAL ANALYSIS OF DIFFERENT AERODYNAMIC CONFIGURATIONS
Lombardi, G., Pisa Univ., Italy; Mengali, G., Pisa Univ., Italy; Beux, F., Scuola Normale Superiore, Italy; Aerodynamic Design and Optimisation of Flight Vehicles in a Concurrent Multi-Disciplinary Environment; June 2000, pp. 6-1 - 6-10; In English; See also 20000061419; Copyright Waived; Avail: CASI; A02, Hardcopy

This paper addresses the problem to define a methodology for the analysis of the performances of different aircraft configurations in the phase of conceptual design. The proposed approach is based on a numerical optimisation procedure where a scalar objective function, the take-off weight, is minimized. The optimisation algorithm has obviously important consequences both from the point of view of the computational times and of the obtained results. For this reason a preliminary discussion is made where various different methodologies are critically compared. Although the best compromise between different approaches is probably given by an integration between a genetic algorithm approach and a classical gradient method, in this phase only the latter procedure has been used to pe$orm the simulations. The methodology takes into account the high number of geometrical parameters and the flight mechanics requirements involved in the problem. A basic example is described, and the use of the proposed methodology to investigate the effects of different geometrical and technological parameters is discussed.
Author
Aerodynamic Configurations; Aircraft Configurations; Measure And Integration; Optimization

20000061426 NASA Ames Research Center, Moffett Field, CA USA
AERO-MECHANICAL DESIGN METHODOLOGY FOR SUBSONIC CIVIL TRANSPORT HIGH-LIFT SYSTEMS
vanDam, C. P., California Univ., USA; Shaw, S. G., California Univ., USA; VanderKam, J. C., California Univ., USA; Brodeur, R. R., California Univ., USA; Rudolph, P. K. C., PKCR, Inc., USA; Kinney, D., NASA Ames Research Center, USA; Aerodynamic Design and Optimisation of Flight Vehicles in a Concurrent Multi-Disciplinary Environment; June 2000, pp. 7-1 - 7-12; In English; See also 20000061419
Contract(s)/Grant(s): NCC2-5188; NCC2-5255; SNL-A0273; A46374D(LAS); A49736D(SLS); Copyright Waived; Avail: CASI; A03, Hardcopy

In today's highly competitive and economically driven commercial aviation market, the trend is to make aircraft systems simpler and to shorten their design cycle which reduces recurring, non-recurring and operating costs. One such system is the high-lift system. A methodology has been developed which merges aerodynamic data with kinematic analysis of the trailing-edge flap mechanism with minimum mechanism definition required. This methodology provides quick and accurate aerodynamic performance prediction for a given flap deployment mechanism early on in the high-lift system preliminary design stage. Sample analysis results for four different deployment mechanisms are presented as well as descriptions of the aerodynamic and mechanism data required for evaluation. Extensions to interactive design capabilities are also discussed.
Author
Procedures; Design Analysis; Subsonic Speed; Operating Costs; Kinematics; Commercial Aircraft; Aerodynamic Characteristics

20000061427 Defence Evaluation Research Agency, Farnborough, UK
CONCEPTUAL DESIGN AND OPTIMISATION OF MODERN COMBAT AIRCRAFT
Crawford, C. A., Defence Evaluation Research Agency, UK; Simm, S. E., Defence Evaluation Research Agency, UK; Aerodynamic Design and Optimisation of Flight Vehicles in a Concurrent Multi-Disciplinary Environment; June 2000, pp. 8-1 - 8-11; In English; See also 20000061419; Copyright Waived; Avail: CASI; A03, Hardcopy

The design of a combat aircraft is an extremely complex task, due to the large range of design variables available. A fundamental understanding of the effects of changes to these variables, and to changes in design/performance requirements, is necessary to achieve a balanced design. At the Defence Evaluation and Research Agency (DERA) this is achieved with the help of conceptual design and optimisation programs, developed and used extensively over the past 20 years or so. These Multi-Variate Optimisation (MVO) programs are rapid assessment tools, enabling the effects of variations in design variables and performance requirements, in terms of overall aircraft sizing and geometric shape. to be quickly demonstrated. The programs are used routinely within the Air Vehicle Performance Group at DERA to conduct trade-off studies. These include assessments of the benefits of new technologies (e.g. in the fields of structures, aerodynamics or engines) and the impact of setting various levels of performance requirement. The results provide information and advice to the military customer, aiding balance of investment decisions and helping with initial concept definition.
Author
Design Analysis; Aircraft Design; Fighter Aircraft

20000061428 Dassault Aviation, Saint-Cloud, France
MULTI-DISCIPLINARY CONSTRAINTS IN AERODYNAMIC DESIGN
Perrier, P., Dassault Aviation, France; Aerodynamic Design and Optimisation of Flight Vehicles in a Concurrent Multi-Disciplinary Environment; June 2000, pp. 10-1 - 10-12; In English; See also 20000061419; Copyright Waived; Avail: CASI; A03, Hardcopy

A long tradition of aerodynamic design of combat vehicles shows that the expression of the targets and the constraints in the design are always difficult to select. Present long iteration processes hide such variable target/constraints continuous reassessment. Every processes of design unable to have flexibility in target/constraint handling is unusable. Fortunately, the geometrical constraints are now better handled in new CAD software with features modeling. The present development of new constrained features modeling will be described from its basic expression to the more complex and variable topology configuration. Fitting the optimization process to the physics of multidisciplinary constraints may not be as easy as for geometry. It is proposed to select a family of constrained variations of geometry, each able to cope with a specific physical optimization and to generate a multiprojection of the multi-constrained operators. Some conceptual examples of such processes will be presented in the case of aeroelastic design electromagnetic design and actively controlled configurations with variable geometry for improvement of

flow control. The specific domains of use of deterministic and stochastic (genetic) algorithm and of self-adaptation by training (neural network) will be assessed. New strategies will be proposed for sharing the work of optimization between different companies cooperating to the design of advanced aerospace vehicles.
Author
Aerodynamics; Design Analysis; Active Control; Aerospace Vehicles; Complex Variables; Computer Aided Design

20000061429 British Aerospace Public Ltd. Co., Military Aircraft and Aerostructures, Warton, UK
ASPECTS OF AERODYNAMIC OPTIMISATION FOR MILITARY AIRCRAFT DESIGN
Probert, B., British Aerospace Public Ltd. Co., UK; Aerodynamic Design and Optimisation of Flight Vehicles in a Concurrent Multi-Disciplinary Environment; June 2000, pp. 11-1 - 11-12; In English; See also 20000061419; Copyright Waived; Avail: CASI; A03, Hardcopy

The paper considers the role of various optimisation strategies in the aerodynamic design of military combat aircraft. The multi - design point targets of military aircraft implies that the final product must achieve a carefully judged balance between, often conflicting, requirements. The current established way of working to achieve this 'balance' is first reviewed including the use of rule based procedures, the application of linearised CFD codes in both direct and inverse/ optimisation modes, and the role of initial experimental data leading on to more detailed CFD work and experimental verification. Practical examples are given relating to the design of various projects including the Experimental Aircraft Programme (EAP), which was the forerunner of Eurotighter. The need for improvements is identified, being primarily brought about by considerations of affordability and reduced design cycle time and also by the challenge posed from novel configurations to met low observability requirements. The means of achieving these improvements is discussed, and these imply the development of Multi Disciplinary Optimisation (MDO) in a wide sense. Numerical optimisation experience is reviewed but it is strongly emphasised that there is a need for rapid experimental input to the configuration design choice programme. Means of achieving this are discussed and examples given. The high incidence requirements have a strong impact on CFD developments and areas of improvement are identified. This leads to a proposed new way of working implying a much stronger interaction between the initial and detailed design phases of aircraft design.
Author
Aircraft Design; Optimization; Aerodynamics; Computational Fluid Dynamics

20000061430 Defence Evaluation Research Agency, Aerodynamics and Hydrodynamics Centre, Farnborough, UK
PROGRESS TOWARDS A MULTI-DISCIPLINARY ANALYSIS AND OPTIMISATION CAPABILITY FOR AIR VEHICLE ASSESSMENT AND DESIGN: A UK RESEARCH ESTABLISHMENT VIEW
Lovell, David, Defence Evaluation Research Agency, UK; Bartholomew, Peter, Defence Evaluation Research Agency, UK; Aerodynamic Design and Optimisation of Flight Vehicles in a Concurrent Multi-Disciplinary Environment; June 2000, pp. 12-1 - 12-11; In English; See also 20000061419; Copyright Waived; Avail: CASI; A03, Hardcopy

This paper considers progress towards establishing a Multidisciplinary Design Optimisation (MDO) capability for assessment and design. Some basic questions are posed and answered on the basis of experience gained by DERA as a result of participation in a series of recent National and International projects undertaken in partnership with UK and European industry and government research agencies. Issues addressed include the definition of MDO: its function within concurrent engineering: the role of product models; the definition and execution of the MD0 process under users control; the use of trade-off studies for requirements capture: and the degree to which MD0 can support detailed design work. The need for the adoption of standards in the definition of the product model is highlighted.
Author
Design Analysis; Optimization; Aircraft Design

20000061431 Defence Evaluation Research Agency, UK
THE APPLICATION OF PARETO FRONTIER METHODS IN THE MULTIDISCIPLINARY WING DESIGN OF A GENERIC MODERN MILITARY DELTA AIRCRAFT
Fenwick, Steven V., Defence Evaluation Research Agency, UK; Harris, John C., Defence Evaluation Research Agency, UK; Aerodynamic Design and Optimisation of Flight Vehicles in a Concurrent Multi-Disciplinary Environment; June 2000, pp. 13-1 - 13-7; In English; See also 20000061419; Copyright Waived; Avail: CASI; A02, Hardcopy

As a partner in the EC Framework IV 'FRONTIER' project, DERA has investigated the application of a genetic algorithm (GA) and Pareto frontier methods to optimize the trade-off between multiple design objectives. A Pareto frontier is defined as the limit of design space beyond which one attribute of a design cannot be improved without detriment to another. DERA has applied the software produced within the project to the multidisciplinary design of the wing of a generic modern military delta aircraft, to trade-off the conflicting design requirements of range and agility. This paper recounts DERA's experience of the methods as an approach to the solution of a trial multidisciplinary design and optimisation (MDO) problem together with some of the results produced. Details of the software produced within the project are provided, along with conclusions and recommendations from its use.
Author
Wings; Design Analysis; Computer Design; Genetic Algorithms

20000061436 Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Inst. of Design Aerodynamics, Brunswick, Germany
A SYSTEM FOR THE AERODYNAMIC OPTIMIZATION OF THREE-DIMENSIONAL CONFIGURATIONS
Orlowski, M., Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; Tang, W., Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; Aerodynamic Design and Optimisation of Flight Vehicles in a Concurrent Multi-Disciplinary Environment; June 2000, pp. 19-1 - 19-13; In English; See also 20000061419; Copyright Waived; Avail: CASI; A03, Hardcopy

The paper presents a system for the aerodynamic optimization of three-dimensional configurations. This system is based on the repeated calculation of the flowfield around three-dimensional geometries by solving the Euler/Navier-Stokes equations. The basic structure of the system and the incorporated modules are described. Under the same conditions the system must provide the same solutions of classic aerodynamic optimization problems as given in literature. So the function of the system is checked with the Rhombus airfoil and the Sears-Haack body. The potential of the system is demonstrated with current aerodynamic optimization problems.
Author
Aerodynamic Configurations; Optimization; Three Dimensional Models

20000061437 Alenia Spazio S.p.A., Divisione Aeronautica, Turin, Italy
ALENIA MULTIDISCIPLINARY DESIGN OPTIMISATION: TOPICS AND APPROACHES
Selmin, V., Alenia Spazio S.p.A., Italy; Vitagliano, P. O., Alenia Spazio S.p.A., Italy; Pennavaria, A., Alenia Spazio S.p.A., Italy; Crosetta, L., Alenia Spazio S.p.A., Italy; Aerodynamic Design and Optimisation of Flight Vehicles in a Concurrent Multi-Disciplinary Environment; June 2000, pp. 20-1 - 20-6; In English; See also 20000061419
Contract(s)/Grant(s): CEC-BE95-2056; Copyright Waived; Avail: CASI; A02, Hardcopy

The purpose of this paper is to report on methods which have been developed or which are under development at Alenia Aeronautica for multidisciplinary optimum design, with particularly emphasis on aerodynamic shape design. Results of transonic 2D and 3D optimisation problems are presented.
Author
Optimization; Design Analysis; Two Dimensional Models; Three Dimensional Models

20000061438 Instituto Nacional de Tecnica Aeroespacial, Fluid Dynamics Dept., Madrid, Spain
DESIGN AND OPTIMIZATION OF WINGS IN SUBSONIC AND TRANSONIC REGIME

Monge, Fernando, Instituto Nacional de Tecnica Aeroespacial, Spain; Jimenez-Varona, Jose, Instituto Nacional de Tecnica Aeroespacial, Spain; Aerodynamic Design and Optimisation of Flight Vehicles in a Concurrent Multi-Disciplinary Environment; June 2000, pp. 21-1 - 21-10; In English; See also 20000061419; Copyright Waived; Avail: CASI; A02, Hardcopy

For a realistic and practical aerodynamic optimization the most appropriate combination of the three sets of tools taking part in the process should be carefully studied. That is, the optimization should allow an easy implementation of constraints, and should be multi-point without the need to prescribe pressure distributions in the objective function; the design space should be broad enough; and the analysis tool should be fast and robust. Taking into account these criteria, a code for multipoint design and optimization of wings in subsonic and transonic regime has been developed and will be described in this paper. The objective can be any combination of the global aerodynamic coefficients, and geometrical and physical constraints can be applied. Results for subsonic and transonic cases will be presented. Flexibility in the use of the design variables allows many different tests to be performed before the best solution is achieved. Lastly, the computational cost is reduced by the use of a low level code for computing the aerodynamic coefficients.
Author

Wings; Design Analysis; Optimization; Subsonic Flow; Transonic Flow

20000061439 Italian Aerospace Research Center, Capua, Italy
A MULTIOBJECTIVE APPROACH TO TRANSONIC WING DESIGN BY MEANS OF GENETIC ALGORITHMS
Vicini, A., Italian Aerospace Research Center, Italy; Quagliarella, D., Italian Aerospace Research Center, Italy; Aerodynamic Design and Optimisation of Flight Vehicles in a Concurrent Multi-Disciplinary Environment; June 2000, pp. 22-1 - 22-12; In English; See also 20000061419; Copyright Waived; Avail: CASI; A03, Hardcopy

In this work a transonic wing design problem is faced by means of a multiobjective genetic algorithm, and using a full potential flow model. The applications here presented regard both planform and wing section optimization. It is shown how both geometric and aerodynamic constraints can be taken into account, and how the multiobjective approach to optimization can be an effective way to handle conflicting design criteria. An interpolation technique allowing a better approximation of Pareto fronts is described. Two possible ways of improving the computational efficiency of the genetic algorithm, namely a parallel implementation of the code and a hybrid optimization approach, are presented.
Author

Aircraft Design; Wings; Design Analysis; Transonic Flow; Genetic Algorithms

20000061440 National Research Council of Canada, Aerodynamics Lab., Ottawa, Ontario Canada
APPLICATION OF MICRO GENETIC ALGORITHMS AND NEURAL NETWORKS FOR AIRFOIL DESIGN OPTIMIZATION
Tse, Daniel C. M., National Research Council of Canada, Canada; Chan, Louis Y. Y., National Research Council of Canada, Canada; Aerodynamic Design and Optimisation of Flight Vehicles in a Concurrent Multi-Disciplinary Environment; June 2000, pp. 23-1 - 23-11; In English; See also 20000061419; Copyright Waived; Avail: CASI; A03, Hardcopy

Genetic algorithms are versatile optimization tools suitable for solving multi-disciplinary optimization problems in aerodynamics where the design parameters may exhibit multi-modal or non-smooth variations. However, the fitness evaluation phase of the algorithms casts a large overhead on the computational requirement and is particularly acute in aerodynamic problems where time-consuming CFD methods are needed for evaluating performance. Methods and strategies to improve the performance of basic genetic algorithms are important to enable the method to be useful for complicated three-dimensional or multi-disciplinary problems. Two such methods are studied in the present work: micro genetic algorithms and artificial neural networks. Both methods are applied to inverse and direct airfoil design problems and the resulting improvement in efficiency is noted and discussed.
Author

Genetic Algorithms; Neural Nets; Airfoils; Design Analysis; Optimization

20000061441 Daimler-Benz Aerospace A.G., Munich, Germany
MULTI-OBJECTIVE AEROELASTIC OPTIMIZATION
Stettner, M., Daimler-Benz Aerospace A.G., Germany; Haase, W., Daimler-Benz Aerospace A.G., Germany; Aerodynamic Design and Optimisation of Flight Vehicles in a Concurrent Multi-Disciplinary Environment; June 2000, pp. 24-1 - 24-8; In English; See also 20000061419
Contract(s)/Grant(s): ESPRDIT Proj. 20082; Copyright Waived; Avail: CASI; A02, Hardcopy

The present work is aiming at an aeroelastic analysis of the X31 delta wing and particularly at the aeroelastic optimization problem of maximizing the aerodynamic roll rate and minimizing the structural weight at supersonic flow speeds. Results are achieved by means of a multi-objective genetic algorithm (GA) utilizing a GUI-supported software being developed in the European-Union funded ESPRIT project FRONTIER.
Author

Aeroelasticity; Optimization; Delta Wings; Genetic Algorithms

20000061442 NASA Marshall Space Flight Center, Huntsville, AL USA
EMERGENT AEROSPACE DESIGNS USING NEGOTIATING AUTONOMOUS AGENTS
Deshmukh, Abhijit, Massachusetts Univ., USA; Middelkoop, Timothy, Massachusetts Univ., USA; Krothapalli, Anjaneyulu, Florida State Univ., USA; Smith, Charles, NASA Marshall Space Flight Center, USA; Aerodynamic Design and Optimisation of Flight Vehicles in a Concurrent Multi-Disciplinary Environment; June 2000, pp. 25-1 - 25-8; In English; See also 20000061419
Contract(s)/Grant(s): NAG2-1114; NSF ARC-99-78923; Copyright Waived; Avail: CASI; A02, Hardcopy

This paper presents a distributed design methodology where designs emerge as a result of the negotiations between different stake holders in the process, such as cost, performance, reliability, etc. The proposed methodology uses autonomous agents to represent design decision makers. Each agent influences specific design parameters in order to maximize their utility. Since the design parameters depend on the aggregate demand of all the agents in the system, design agents need to negotiate with others in the market economy in order to reach an acceptable utility value. This paper addresses several interesting research issues related to distributed design architectures. First, we present a flexible framework which facilitates decomposition of the design problem. Second, we present overview of a market mechanism for generating acceptable design configurations. Finally, we integrate learning mechanisms in the design process to reduce the computational overhead.
Author

Decomposition; Design Analysis; Systems Engineering; Decision Making; Architecture; Structural Design

20000061445 Loughborough Univ. of Technology, Dept. of Aeronautical and Automotive Engineering, UK
DESIGN TOOLS FOR PERFORMANCE ASSESSMENT OF FIGHTER AIRCRAFT INCORPORATING NEW TECHNOLOGIES
Kutschera, Anthony, Loughborough Univ. of Technology, UK; Render, Peter M., Loughborough Univ. of Technology, UK; Aerodynamic Design and Optimisation of Flight Vehicles in a Concurrent Multi-Disciplinary Environment; June 2000, pp. 29-1 - 29-9; In English; See also 20000061419; Copyright Waived; Avail: CASI; A02, Hardcopy

The performance assessment of modern fighter aircraft has been the subject of considerable research in recent years. A new metric called Nodal Maneuver Analysis has been proposed, which allows performance assessment of new technologies to be carried out during the conceptual/preliminary design stages of an aircraft. This paper seeks to demonstrate the uses of the Nodal Maneuver Analysis metric by considering three case studies. These studies assess the changes in performance of a baseline aircraft in a vertical turn maneuver, when new technology is incorporated. The technologies are 1) an increase in thrust, 2) a reduction in weight, and 3) the incorporation of Thrust Vectoring and Post Stall Maneuverability. Through these studies, it is shown that Nodal Maneuver Analysis can quantify the advantages/disadvantages of incorporating new technology into the design.
Author

Design Analysis; Software Development Tools; Performance Prediction; Fighter Aircraft; Technology Assessment

20000061447 Aerospatiale, Matra Missiles, Chatillon, France
INLET/BODY INTEGRATION PRELIMINARY DESIGN FOR SUPERSONIC AIR-BREATHING MISSILES USING AUTOMATED MULTI-DISCIPLINARY OPTIMIZATION
Kergaravat, Yan, Aerospatiale, France; Vives, Eric, Aerospatiale, France; Knight, Doyle, Rutgers - The State Univ., USA; Aerodynamic Design and Optimisation of Flight Vehicles in a Concurrent Multi-Disciplinary Environment; June 2000, pp. 31-1 - 31-12; In English; See also 20000061419; Copyright Waived; Avail: CASI; A03, Hardcopy

In order to reduce the design cycle time and cost and to improve the multi-disciplinary interactions at the preliminary design stage of supersonic air-breathing missiles, an automated optimization method has been developed for inlet/body integration in a concurrent engineering environment. Three disciplines of higher relevance have been considered for the shape optimization problem: propulsion, aerodynamics and electromagnetics. This paper describes the numerical method, which incorporates a genetic algorithm and three analysis modules into the optimization loop. The parametric model of the generic missile is presented. The optimization problem is defined and solved for a given mission and set of specifications. The problem is addressed in three phases corresponding to an increasing number of concurrent disciplines. This progression enables to emphasize the conflicting goals between the disciplines and to understand how the optimizer yields the best compromises. This preliminary study shows interesting results and strong potential for future development and industrial applications.
Author
Air Breathing Engines; Concurrent Engineering; Genetic Algorithms; Design Analysis; Optimization; Procedures; Supersonic Inlets

20000061449 British Aerospace Public Ltd. Co., Mathematical Modelling Dept., Bristol, UK
RAPID AERODYNAMIC DATA GENERATION USING AN ITERATIVE APPROXIMATION METHOD
Toomer, C. A., British Aerospace Public Ltd. Co., UK; Aerodynamic Design and Optimisation of Flight Vehicles in a Concurrent Multi-Disciplinary Environment; June 2000, pp. 33-1 - 33-11; In English; See also 20000061419; Original contains color illustrations; Copyright Waived; Avail: CASI; A03, Hardcopy

Aerodynamic design and optimisation is a costly and complicated process in which numerically generated information about the design space plays a vital role. Hence the information needs to be of good quality, i.e. describing the correct physics, and to be easily accessible from databases using standardised formats. To make this process affordable and efficient, the codes must be fast, robust and accurate. Aerodynamic design problems tend to involve a large number of design parameters and constraints on the design. Large data sets are generated and so it is wise to automate the data generating and processing whenever possible. Data generation is only part of the process. Efficient algorithms to access and interpret the data are required, as is an efficient means of negotiating through the design space. Optimisation is the usual method by which the data are analysed, and regions within the design space identified as possible design solutions or improvements to existing designs.
Author
Aerodynamics; Data Bases; Data Processing; Design Analysis; Optimization

20000061450 Naples Univ., Dipartimento di Progettazione Aeronautica, Italy
DESIGN AND AERODYNAMIC OPTIMIZATION OF A NEW RECONNAISSANCE VERY LIGHT AIRCRAFT THROUGH WIND-TUNNEL TESTS
Giordano, V., Naples Univ., Italy; Coiro, D. P., Naples Univ., Italy; Nicolosi, F., Naples Univ., Italy; DiLeo, L., Naples Univ., Italy; Aerodynamic Design and Optimisation of Flight Vehicles in a Concurrent Multi-Disciplinary Environment; June 2000, pp. 34-1 - 34-8; In English; See also 20000061419; Copyright Waived; Avail: CASI; A02, Hardcopy

Design of a new Very Light Aircraft (V.L.A.) called G97 Spotter has been carried out at DPA (Department of Aeronautical Engineering) and an extensive wind tunnel test campaign has been performed on both aircraft and airfoil models. Wind tunnel tests have guided in the design phase allowing configuration optimization. Effects of nacelle and air intake shape, fuselage stretching, wing incidence and flap/aileron effectiveness have been analyzed through wind tunnel tests. The airfoil has also been designed and modified with the help of wind tunnel test results obtained for a model. Optimization of the airfoil leading edge shape has been done and has brought to a sensible drag reduction at high speed conditions. Optimization of the air intake shape on the aircraft model has been performed leading to a configuration characterized by lower drag. Influence of an air intake fairing has been analyzed and tested through wind tunnel tests. Wing stall path has been studied. Importance of wind tunnel tests as a device to analyze and design light aircraft configuration has been highlighted.
Author
Aerodynamic Stalling; Design Analysis; Ailerons; Aircraft Models; Drag Reduction; Light Aircraft; Optimization; Wind Tunnel Tests

20000101666 Research and Technology Organization, Systems Concepts and Integration Panel, Neuilly-sur-Seine, France
SIMULATION IN SUPPORT OF FLIGHT TESTING *[LA SIMULATION POUR LE SOUTIEN DES ESSAIS EN VOL]*
Hines, Dennis O., Research and Technology Organization, France; September 2000; 57p; In English; The CD-ROM contains full text document in PDF format
Report No.(s): RTO-AG-300-Vol-19; AC/323(SCI)TP/27-Vol-19; ISBN-92-837-1043-6; Copyright Waived; Avail: CASI; A04, Hardcopy; A01, Microfiche; C01, CD-ROM

For over 40 years simulation has played a key role in flight testing. The purpose of this AGARDograph is to provide an introduction to simulation and how it can be used to support flight testing of fixed-wing aircraft. The document starts by considering the role of simulation, including a brief history and the costs and benefits associated with it. It then discusses the following types of simulations: analytic (non real-time), engineering or man-in-the-loop (real-time), hardware-in-the-loop, Iron Bird, and in-flight. Simulation development considerations described include: requirements definition; modelling of flight control systems, aerodynamics and the environment; cockpit fidelity, displays and force-feel systems; visual scenes, data display and analysis, including simulation and flight test integration; and verification and validation. The final sections consider how to conduct a simulation-based test programme and the future direction of simulation.
Author
Flight Simulation; Flight Tests; Flight Simulators; Aerodynamics; Fixed Wings; Aircraft Configurations

20000105089 Institut de Medicine Aerospatiale Armee, Departement Sciences Cognitives, Bretigny sur Orge, France
MODERN COCKPITS: HOW TO STAY COMPETITIVE OVER TIME
Roumes, Corinne, Institut de Medicine Aerospatiale Armee, France; Amalberti, Rene, Institut de Medicine Aerospatiale Armee, France; Operational Issues of Aging Crewmembers; August 2000, pp. 35-1-35-5; In French; See also 20000105060; Copyright Waived; Avail: CASI; A02, Hardcopy

Perceptual and cognitive capacities decrease due to aging can affect pilots' efficiency in flight. Pilots' expertise simultaneously improves as training is performed. This expertise tends to counterbalance functional impairments. To further keep aging effects in check, specific training and pilot management on one hand, cockpit design on the other hand must be implemented. At the cockpit display level, an adaptive interface is a relevant suggestion.
Author
Visual Perception; Visual Observation; Cognitive Psychology; Cognition; Age Factor; Aging (Biology); Mental Performance

20000108804 Raytheon Co., Alpharetta, GA USA
MISSILE SEEKERS FOR STRIKE WARFARE BEYOND THE YEAR 2000
Licata, William H., Raytheon Co., USA; Technologies for Future Precision Strike Missile Systems; September 2000, pp. 4-1 - 4-9; In English; See also 20000108801; Copyright Waived; Avail: CASI; A02, Hardcopy

The goal of this paper is to explore emerging post Cold War missile seeker requirements that will lead to new seeker procurements in the year 2000+. These requirements are compared to existing missile seeker products to show where technology deficiencies exist. A projection is made of what seekers will be deployed in the near future to fill important military missile user needs and where

technology investments will me made to develop fully capable missile seekers. The orientation of the presentation is on missile seekers as a product and the functionality they provide the military user community. Therefore, the presentation discusses new functionality not included in seekers built in the 1900's because of technology limitations or lack of sufficient user requirements.
Author
Homing Devices; Missile Control; Radar Homing Missiles; Missile Systems; Target Recognition; Missile Signatures; Trajectory Control; Military Technology

20000108805 Georgia Inst. of Tech., Aerospace Systems Design Lab., Atlanta, GA USA
TECHNOLOGIES FOR FUTURE PRECISION STRIKE MISSILE SYSTEMS: MISSILE DESIGN TECHNOLOGY
Fleeman, Eugene L., Georgia Inst. of Tech., USA; Technologies for Future Precision Strike Missile Systems; September 2000, pp. 5-1 - 5-13; In English; See also 20000108801; Copyright Waived; Avail: CASI; A03, Hardcopy

This paper provides an assessment of the state-of-the-art and design considerations of missile design technology for future precision strike missile systems. Benefits of missile design technology include advanced missile concepts, identification of driving parameters, balanced subsystems, incorporation of new technologies, light weight/low cost missiles, and launch platform compatibility. The paper discusses the missile design process, presents examples of simulation and spreadsheet conceptual design computer programs, provides missile configuration design criteria, and lists references that are applicable to missile design technology.
Author
Missile Design; Missile Systems; Missile Configurations; Design Analysis; Parameter Identification; Systems Engineering; Missile Control; Structural Design

20000108806 Georgia Inst. of Tech., Aerospace Systems Design Lab., Atlanta, GA USA
TECHNOLOGIES FOR FUTURE PRECISION STRIKE MISSILE SYSTEMS: MISSILE/AIRCRAFT INTEGRATION
Fleeman, Eugene L., Georgia Inst. of Tech., USA; Technologies for Future Precision Strike Missile Systems; September 2000, pp. 7-1 - 7-9; In English; See also 20000108801; Copyright Waived; Avail: CASI; A02, Hardcopy

This paper provides an assessment of the state-of-the-art and design considerations of missile/aircraft integration for future precision strike missile systems. Benefits of missile/aircraft integration include compatibility with a broader range of aircraft carriage platforms, unrestricted carriage envelope, safe and accurate store separation, and enhanced survivability for the aircraft platform. Technologies and design considerations are grouped into the following discussion areas: Missile factor of safety compatibility- Assessments in this area include structural design factor of safety, carriage flight loads, and design specification of the carriage flight environment; Missile carriage and launch compatibility- Assessments in this area include launch platform compatibility constraints, firepower, launcher alternatives, compressed carriage, and standard suspension requirements; and Survivability (missile observables/insensitive munitions) compatibility- Assessments in this area include internal carriage, reduced observable plumes, and insensitive munitions.
Author
Missile Systems; Aircraft Design; Systems Integration; Systems Compatibility; Systems Engineering; Structural Design; Flight Control

20000108807 Swedish Defence Research Establishment, Stockholm, Sweden
SIMULATION/DESIGN VALIDATION TECHNOLOGY
Berglund, Erik, Swedish Defence Research Establishment, Sweden; Technologies for Future Precision Strike Missile Systems; September 2000, pp. 8-1 - 8-6; In English; See also 20000108801; Copyright Waived; Avail: CASI; A02, Hardcopy

Simulation plays an increasingly important role in the development of new missile systems. This paper contains a brief overview of the various types of simulation models used in different phases of design and evaluation. The main emphasis is placed on trajectory simulation models. The usefulness of different trajectory models for different purposes is treated. A recommendation is to avoid using more complicated models than are required to address the problem of interest. The problem of using a very limited number of test firings to validate a highly complex model is mentioned.
Author
Missile Systems; Systems Simulation; Aerodynamics; Systems Engineering; Two Dimensional Models; Systems Analysis

20000119924 Dassault Aviation, Saint-Cloud, France
SUPPORTABILITY IN DESIGN AND LOW LIFE CYCLE COST (LCC) : THE MIRAGE 2000 EXAMPLE *[SUPPORTABILITE EN CONCEPTION ET FAIBLE COUT GLOBAL: L'EXEMPLE DU MIRAGE 2000]*
Lemaignen, Louis, Dassault Aviation, France; Huet, Franck, Dassault Aviation, France; Rajabaly, Maleck, Dassault Aviation, France; Design for Low Cost Operation and Support; September 2000, pp. 6-1 - 6-7; In English; See also 20000119918; Copyright Waived; Avail: CASI; A02, Hardcopy

Though not fully designed, as later the RAFALE was, through a true Integrated Logistic Support (ILS) methodology, the MIRAGE 2000 received, during its design phases, a strong involvement of the future Users and took benefit of Dassault Aviation's experience and operational feedback from previous programs to give it the 'abilities' of a highly available and maintainable aircraft. The overall approach of 'Supportability in Design' is presented and the way the 'capabilities' have been incorporated in the A/C definition and its evolution are highlighted. The major technical choices and their 'Supportability' aspects are presented. The field-demonstrated Support characteristics show how the objectives have been met. For a given design, different logistic solutions are possible, depending on the specific Customer and the size of his fleet, to reduce the Life Cycle Cost (LCC) without impairing the operational use of the fleet. Such an optimisation, using an LCC tool, is presented.
Author
Low Cost; Cost Reduction; Life Cycle Costs; Cost Effectiveness; Cost Analysis; Design To Cost

20000119926 Aerospatiale Matra Airbus, Toulouse, France
AIRCRAFT DESIGN TO OPERATIONAL COST
Gosselin, Stephane, Aerospatiale Matra Airbus, France; Design for Low Cost Operation and Support; September 2000, pp. 9-1 - 9-12; In English; See also 20000119918; Copyright Waived; Avail: CASI; A03, Hardcopy

The method that will be presented to you is used on Airbus products. The aim of this presentation is to give you an overview and some indications on the process and the associated tools that we have developed to ensure that the design of our products is coherent with the operators expectations in term of operational costs. The presentation will first show the evolution of the market and of the operators expectations that drove the emergence of the Integrated Logistic Support concept. This will be followed by a description of how we have adapted this concept in a very pragmatic procedure applicable to military transport as well as commercial aircraft design. The five steps of the procedure will then be detailed. An overview of the existing tools and of the environment in which this procedure is applied will follow.
Derived from text
Aircraft Design; European Airbus; Design To Cost; Operating Costs; Production Costs; Cost Analysis; Life Cycle Costs

20000119927 DaimlerChrysler Aerospace A.G., Military Aircraft Div., Munich, Germany
REQUIREMENTS, DESIGN FEATURES AND MANUFACTURING TECHNIQUES LEADING TO REDUCED OPERATIONAL COST FOR ADVANCED MILITARY AIRFRAME STRUCTURES
Voglsinger, M., DaimlerChrysler Aerospace A.G., Germany; Mennle, E., DaimlerChrysler Aerospace A.G., Germany; Blas, G., DaimlerChrysler Aerospace A.G., Germany; Design for Low Cost Operation and Support; September 2000, pp. 10-1 - 10-11; In English; See also 20000119918; Copyright Waived; Avail: CASI; A03, Hardcopy

Reliability has a key role to play in successful deployment of the Eurofighter/Typhoon, because its air force customers are relying on improved availability rates, and therefore buying fewer aircraft than would previously have been required. A set of M, R + T-requirements derived from previous in-service-aircraft-programs has been established, amended by new technology potentials and airforce customers demands. Selected design criteria, design features and manu-

facturing techniques supporting the goal of reduced operational cost are detailed below.
Derived from text
Cost Reduction; Operating Costs; Cost Analysis

20000119932 British Aerospace Public Ltd. Co., Military Aircraft and Aerostructures, Warton, UK
THE ULTRA RELIABLE AIRCRAFT
Bottomley, Ted, British Aerospace Public Ltd. Co., UK; Design for Low Cost Operation and Support; September 2000, pp. 14bis-1 - 14bis-4; In English; See also 20000119918; Copyright Waived; Avail: CASI; A01, Hardcopy

Rather than a flying aircraft, the Ultra Reliable Aircraft (URA) is a research project which aims to enable substantial increases in aircraft operational availability and reliability. Customers, both civil and military, now expect reduced costs with improved satisfaction and UK industry must take action to meet these new challenges. In response, the Society of British Aerospace Companies (SBAC) through their Foresight Action program, initiated the Ultra Reliable Aircraft program. This program has, as its ultimate objective, the elimination of all unscheduled aircraft maintenance. However, at the current rate of design and development effort, and in terms of reliability, attempts to dramatically increase the in-service reliability of systems and equipment are providing diminishing returns. Even when new technology and increased complexity are taken into account, what is needed is a step change in reliability performance to break the trend and realise the levels of reliability required to respond to the new challenges.
Author
Aircraft Reliability; Research And Development; Operations Research

20010002552 Boeing Co., Mesa, AZ USA
STRUCTURAL INTEGRITY AND AGING-RELATED ISSUES FOR HELICOPTERS
Sen, Joyanto K., Boeing Co., USA; Everett, Richard A., Army Vehicle Technology Center, USA; Aging Engines, Avionics, Subsystems and Helicopters; October 2000, pp. 5-1 - 5-21; In English; See also 20010002548; Copyright Waived; Avail: CASI; A03, Hardcopy

The question of the structural integrity of aging aircraft became an issue of grave concern when an Aloha Airlines Boeing 737 suffered major structural damage in April 1988 while in flight. Since then the airworthiness issue of aging aircraft has been the concern of manufacturers, and civilian and military operators alike. The issues for civilian and military operators are structural integrity and reduced ownership cost when the service life is extended. The military have the additional task of maintaining preparedness with improved availability and enhancing the performance of aircraft designed for now-obsolescent missions to meet new mission requirements. Aging, therefore, does not mean 'old' in terms of the number of calendar days, but the cumulative effect of technical obsolescence, changing requirements, quality of maintenance and the nature of operation (i.e., load and environment).
Author
Aircraft Reliability; Aging (Materials); Damage; Structural Failure; Structural Reliability; Aircraft Safety

20010002553 Panavia Aircraft G.m.b.H., Munich, Germany
AGING AIRCRAFT SUBSYSTEMS EQUIPMENT LIFE EXTENSION WITHIN THE TORNADO PROGRAM
Blech, G., Panavia Aircraft G.m.b.H., Germany; Aging Engines, Avionics, Subsystems and Helicopters; October 2000, pp. 6-1 - 6-24; In English; See also 20010002548; Copyright Waived; Avail: CASI; A03, Hardcopy

Restrictions on nations military budgets require that Air Forces will operate highly sophisticated weapon systems such as military aircraft far beyond their original designed life. Modernization, life extension and aging aircraft programs are defined to ensure that future mission requirements can be fulfilled and the airworthiness of the aircraft is maintained until the out of service date. Whilst the operational life is increasing, various aging effects take place and impair the structural and functional integrity of high aged aircraft subsystems even before their design life are reached. An integrated process was defined between customer and industry with the aim of extending the operational life of the aircraft under limited budgetary conditions and tight timescales. Under the scope of this task, aging of equipment and components, the impact of aging problems on structural and functional integrity, the impact of customer extended operational requirements on equipment limitations and the consequences of age related failures on flight safety have been assessed. Recommendations for revised maintenance and inspection programs and revised limitations have been or will be worked out by industry for safety and non-safety relevant equipment to enable formal certification of the aircraft for the extended period. This work is generally accompanied by equipment design review, review of the in-service usage, investigation of reported in-service problems and related statistics, master inspections of subsystems in high aged aircraft and investigation of aged loan equipment, provided by the Air Forces. Additionally, programs are conducted to establish revised in-service operational conditions. Various programs have been defined by the FAA and US Air Force, which aim on addressing safety issues in aging aircraft structural and non-structural systems. For the 20 years old Tornado aircraft, a life extension program for structure, subsystems and engine is presently being carried out, whose results should enable certification of the aircraft for the extended operational phase and support safe operation of the aircraft for the next 25 years which means a life extension by roughly one aircraft life. This paper discusses the various aspects related to aging of subsystems and the content and philosophy of the Tornado equipment life extension program. Furthermore specific problems identified in various subsystems are presented together with a description of the way ahead for life extension.
Author
Aging (Materials); Aircraft Equipment; Aircraft Reliability; Aircraft Safety; Design Analysis; Flight Safety

20010009843 British Aerospace Aircraft Group, Military Aircraft and Aerostructures, Brough, UK
F-5 CFD RESULTS
Henshaw, Michael J. de C., British Aerospace Aircraft Group, UK; Guillermot, Stephane, Dassault Aviation, France; Verification and Validation Data for Computational Unsteady Aerodynamics; October 2000, pp. 97-133; In English; See also 20010009839; Original contains color illustrations; Copyright Waived; Avail: CASI; A03, Hardcopy

The F-5 test series provides a succession of geometries of increasing complexity, which will be useful for validating CFD codes during their development. Jn this chapter a range of CFD results are provided for the clean wing configuration at selected flow conditions. and a more limited set for one complex configuration. Results from essentially state of the art UTSP (Unsteady Transonic Small Perturbation), Full Potential, Euler. and NS (Navier-Stokes) codes are presented, this will allow the reader to gauge anticipated modelling accuracy for code development purposes. It is summarizes the methods used by contributors reported herein, the methods themselves are described in a standard preforma and the results collated as a series of plots. The flow conditions calculated are summarized. Two or more methods are presented for each level of modelling approximation in order to assist the reader in gauging the likely level of variation in solution at a particular level of approximation.
Author
Performance Tests; Computational Fluid Dynamics; Geometry; Aerodynamic Configurations

20010009844 National Aerospace Lab., Netherlands
F-5 WING AND F-5 WING + TIP STORE
Geurts, Evert G. M., National Aerospace Lab., Netherlands; Verification and Validation Data for Computational Unsteady Aerodynamics; October 2000, pp. 135-152; In English; See also 20010009839; Copyright Waived; Avail: CASI; A03, Hardcopy

This data set relates to a transonic wind tunnel investigation carried out in 1977 on an oscillating, slightly modified model of the outer part of a Northrop F-5 wing with and without an external store. The store represented an AIM-9J missile including its launcher. These tests were reported. The model proceeded from an F-5 wing model for subsonic tests by a slight reduction of the model span, needed to accommodate the tip store considered in the document. In streamwise direction the wing possesses a modified NACA 65-A-004.8 airfoil, characterized by a droopnose, extending from the leading edge towards the point of maximum thickness at 40 per cent of the chord. The aim of the experiments was to determine the unsteady aerodynamic loads on a representative fighter type wing in the transonic and low supersonic speed regimes. Detailed steady

and unsteady pressure distributions were measured over the wing, while on the store strain gauge balances obtained aerodynamic loads. To study the effect of the external store on the unsteady wing loading (interference effects) as well as the unsteady loads on the store itself and its components, the model was tested in various stages of completeness. Starting with the clean wing, successively more parts of the store (launcher, missile body, aft wings, canard fins) were added. Data presented here refer accordingly to the F-5 clean wing configuration, growing in steps to the configuration of the F-5 wing with complete tip store. The model geometry described in the Formulary concerns only the clean wing; geometry data concerning the tip store are not described in this document. However, they are presented in the figures and they are contained in the database on the CD-ROM, accompanying this chapter. Simultaneously with these measurements also wind tunnel wall pressures were recorded to support wall interference effect studies. In the same test also various stages of an underwing missile were measured (pylon, launcher, missile body with aft wings, complete missile). However, no underwing missile data are included in this document. Subsonic tests on the unmodified wing model in different tip store and underwing configurations were extensively reported. Tests on the same wing but with an inboard control surface were reported. The tests on the F-5 wing and F-5 wing with tip store were carried out in the High Speed Tunnel of the National Aerospace Laboratory NLR, in Amsterdam, The Netherlands. The tests covered the Mach number range between Ma = 0.6 and Ma = 1.35, and frequencies up to 40 Hz. An overview of the selected data is given. For steady measurements steady values are presented; for unsteady measurements mean values are represented as well as real and imaginary part of the unsteady values.
Author
Aerodynamic Configurations; Aerodynamic Loads; Airfoils; Data Bases; Pressure Distribution; Transonic Wind Tunnels; Unsteady Aerodynamics

20010009845 NASA Langley Research Center, Hampton, VA USA
TEST CASES FOR A RECTANGULAR SUPERCRITICAL WING UNDERGOING PITCHING OSCILLATIONS
Bennett, Robert M., NASA Langley Research Center, USA; Verification and Validation Data for Computational Unsteady Aerodynamics; October 2000, pp. 153-172; In English; See also 20010009839; Copyright Waived; Avail: CASI; A03, Hardcopy

Steady and unsteady measured pressures for a Rectangular Supercritical Wing (RSW) undergoing pitching oscillations have been presented. From the several hundred compiled data points, 27 static and 36 pitching oscillation cases have been proposed for computational Test Cases to illustrate the trends with Mach number, reduced frequency, and angle of attack. The wing was designed to be a simple configuration for Computational Fluid Dynamics (CFD) comparisons. The wing had an unswept rectangular planform plus a tip of revolution, a panel aspect ratio of 2.0, a twelve per cent thick supercritical airfoil section, and no twist. The model was tested over a wide range of Mach numbers, from 0.27 to 0.90, corresponding to low subsonic flows up to strong transonic flows. The higher Mach numbers are well beyond the design Mach number such as might be required for flutter verification beyond cruise conditions. The pitching oscillations covered a broad range of reduced frequencies. Some early calculations for this wing are given for lifting pressure as calculated from a linear lifting surface program and from a transonic small perturbation program. The unsteady results were given primarily for a mild transonic condition at M = 0.70. For these cases the agreement with the data was only fair, possibly resulting from the omission of viscous effects. Supercritical airfoil sections are known to be sensitive to viscous effects (for example, one case cited). Calculations using a higher level code with the full potential equations have been presented for one of the same cases, and with the Euler equations. The agreement around the leading edge was improved, but overall the agreement was not completely satisfactory. Typically for low-aspect-ratio rectangular wings, transonic shock waves on the wing tend to sweep forward from root to tip such that there are strong three-dimensional effects. It might also be noted that for most of the test, the model was tested with free transition, but a few points were taken with an added transition strip for comparison. Some unpublished results of a rigid wing of the same airfoil and planform that was tested on the pitch and plunge apparatus mount system (PAPA) showed effects of the lower surface transition Strip on flutter at the lower subsonic Mach numbers. Significant effects of a transition strip were also obtained on a wing with a thicker supercritical section on the PAPA mount system. Both of these flutter tests on the PAPA resulted in very low reduced frequencies that may be a factor in this influence of the transition strip. However, these results indicate that correlation studies for RSW may require some attention to the estimation of transition location to accurately treat viscous effects. In this report several Test Cases are selected to illustrate trends for a variety of different conditions with emphasis on transonic flow effects. An overview of the model and tests is given and the standard formulary for these data is listed. Sample data points are presented in both tabular and graphical form. A complete tabulation and plotting of all the Test Cases is given. Only the static pressures and the real and imaginary parts of the first harmonic of the unsteady pressures are available. All the data for the test are available in electronic file form. The Test Cases are also available as separate electronic files.
Author
Performance Tests; Rectangular Wings; Pitch (Inclination); Pressure Measurement; Airfoil Profiles; Wing Oscillations

20010009849 NASA Langley Research Center, Hampton, VA USA
TEST CASES FOR A CLIPPED DELTA WING WITH PITCHING AND TRAILING-EDGE CONTROL SURFACE OSCILLATIONS
Bennett, Robert M., NASA Langley Research Center, USA; Verification and Validation Data for Computational Unsteady Aerodynamics; October 2000, pp. 239-255; In English; See also 20010009839; Copyright Waived; Avail: CASI; A03, Hardcopy

Steady and unsteady measured pressures for a Clipped Delta Wing (CDW) undergoing pitching oscillations and trailing-edge control surface oscillations have been presented . From the several hundred compiled data points, 22 static cases, 12 pitching-oscillation cases, and 12 control-surface-oscillation cases have been proposed for Computational Test Cases to illustrate the trends with Mach number, reduced frequency, and angle of attack. The planform for this wing was derived by simplifying the planform of a proposed design for a supersonic transport which is described as the Boeing 2707-300. The strake was deleted, the resulting planform was approximated by a trapezoid with an unswept trailing edge, and the twist and camber were removed. In order to facilitate pressure instrumentation, the thickness was increased to 6 percent from the typical 2.5 to 3 percent for the supersonic transport. The airfoil is thus a symmetrical circular arc section with t/c = 0.06. A wing of similar planform but with a thinner airfoil of t/c = 0.03 was used in the flutter investigations, and the buffet and stall flutter investigation . Flutter results are also reported both for the 3 per cent thick simplified wing and for a more complex SST model. One of the consequences of the increased thickness of the clipped delta wing is that transonic effects are enhanced for Mach numbers near one. They are significantly stronger than would be the case for the thinner wing. Also, with the combination of high leading edge sweep of 50.5, and the sharp leading edge, a leading edge vortex forms on the wing at relatively low angles of attack, on the order of three degrees. The Appendix discusses some of the vortex flow effects. In addition, a shock develops over the aft portion of the wing at transonic speeds such that at some angles of attack, there is both a leading edge vortex and a shock wave on the wing. Such cases are a computational challenge. Some previous applications of this data set have been for the evaluation of an aerodynamic panel method and for evaluation of a Navier-Stokes capability. Linear theory and panel method results are also presented, which demonstrated the need for inclusion of transonic effects. Flutter calculations for the related wing with t/c=O.O3 are given. In this report several Test Cases are selected to illustrate trends for a variety of different conditions with emphasis on transonic flow effects. An overview of the model and tests are given, and the standard formulary for these data is listed. For each type of data, a sample table and a sample plot of the measured pressures are presented. A complete tabulation and plotting of the Test Cases is given. Only the static pressures and the 1st harmonic real and imaginary parts of the pressures are available. All of the data for the test are included in a microfiche document in the original report and are available in electronic file form. The Test Cases are also available as separate electronic files.
Author
Delta Wings; Control Surfaces; Airfoils; Static Pressure; Pressure Measurement; Unsteady Aerodynamics; Aerodynamic Stalling

20010009850 Office National d'Etudes et de Recherches Aerospatiales, Chatillon, France
SUPERSONIC 2D WING WITH CONTROL SURFACES
Naudin, P., Office National d'Etudes et de Recherches Aerospatiales, France; Verification and Validation Data for Computational Unsteady Aerodynamics; October 2000, pp. 257-270; In English; See also 20010009839; Copyright Waived; Avail: CASI; A03, Hardcopy

For some years ONERA, in collaboration with AEROSPATIALE, has undertaken research into improvement of CFD codes, in the framework of studies on a new supersonic plane. The main goal has been to take unsteady effects, induced by movements of control surfaces such as spoilers or trailing edge flaps, into account with improved accuracy. For this purpose a wind tunnel test was carried out to provide an extensive database of unsteady behavior of control surfaces in supersonic conditions. ONERA has designed a generic 2D rigid model with two control surfaces: a spoiler and a trailing edge flap. These two control surfaces were moved in rotation by electro-hydraulic actuators, allowing an adjustment in static position as well as a harmonic excitation. A model with steady and unsteady pressure transducers, and accelerometers, was installed in the ONERA S2 wind tunnel at Modane in March 1994.
Author
Computational Fluid Dynamics; Two Dimensional Models; Wings; Control Surfaces; Trailing Edge Flaps

20010009851 Defence Evaluation Research Agency, Farnborough, UK
RAE TESTS ON AGARD TAILPLANE
Kaynes, I. W., Defence Evaluation Research Agency, UK; Verification and Validation Data for Computational Unsteady Aerodynamics; October 2000, pp. 271-293; In English; See also 20010009839; Copyright Waived; Avail: CASI; A03, Hardcopy

This data set relates to tests at RAE which were carried out and reported by D G Mabey, B L Welsh and B E Cripps. The tests were undertaken to provide data for the validation of codes for the prediction of both steady and unsteady pressures on low aspect ratio configurations, suitable for the wings or controls of military aircraft. Comprehensive measurements have not been available to verify such codes, although some measurements were obtained during the NORA programme. This was a collaborative test on a low aspect ratio model oscillating about a swept axis, with the main aim of investigating dynamic interference in transonic wind tunnels. NORA was named after the participating organisations: NLR, ONERA, RAE, and AVA (branch of DFVLR). For the verification of transonic theories, a serious limitation of the NORA tests was that the steady and unsteady pressures were measured at different sections, with only a few measurements at each section. To overcome the lack of comprehensive measurements on a low aspect ratio configuration it was decided to make extensive measurements of steady and unsteady pressures on a model of the AGARD SMP (Structures and Materials Panel) tailplane, which has a platform similar to that of the wings and controls used on many military aircraft. Previous tests have shown that for experiments in time-dependent aerodynamics it is essential to minimise aeroelastic distortion when the model is driven. To avoid measured pressures with a significant contribution due to the distortion in the present tests, the model had to move almost as a rigid body when it was oscillated at high frequencies. Hence the model was constructed in carbon fibre, which provided both high stiffness and low inertia. The high stiffness was aided by the 10% thickness of the section used, which is significantly thicker than the sections usually employed on combat aircraft. These two parameters ensured that the first bending frequency was high for a model of this size, 180 Hz when bolted to a large mass reducing to 120 Hz when the model was mounted on the drive system. This determined the maximum drive frequency to about 70 Hz, up to which frequency the model distortions were small. This paper considers the measurements made in the RAE 3fi Wind Tunnel at Bedford in December 1982. The same model has been tested over a wider range of conditions in the DFVLR Im Tunnel at Gottingen in October 1983 under a collaborative programme.
Author
Data Acquisition; Aeroelasticity; Bending; Oscillations; Rigid Structures; Transonic Wind Tunnels

20010009857 NASA Ames Research Center, Moffett Field, CA USA
LARGE-AMPLITUDE, HIGH-RATE ROLL OSCILLATIONS OF A 65 DEG DELTA WING AT HIGH INCIDENCE
Chaderjian, Neal M., NASA Ames Research Center, USA; Schiff, Lewis B., NASA Ames Research Center, USA; Verification and Validation Data for Computational Unsteady Aerodynamics; October 2000, pp. 407-414; In English; See also 20010009839; Copyright Waived; Avail: CASI; A02, Hardcopy

The IAR/WL 65 deg delta wing experimental results provide both detail pressure measurements and a wide range of flow conditions covering from simple attached flow, through fully developed vortex and vortex burst flow, up to fully-stalled flow at very high incidence. Thus, the Computational Unsteady Aerodynamics researchers can use it at different level of validating the corresponding code. In this section a range of CFD results are provided for the 65 deg delta wing at selected flow conditions. The time-dependent, three-dimensional, Reynolds-averaged, Navier-Stokes (RANS) equations are used to numerically simulate the unsteady vertical flow. Two sting angles and two large- amplitude, high-rate, forced-roll motions and a damped free-to-roll motion are presented. The free-to-roll motion is computed by coupling the time-dependent RANS equations to the flight dynamic equation of motion. The computed results are compared with experimental pressures, forces, moments and roll angle time history. In addition, surface and off-surface flow particle streaks are also presented.
Author
Navier-Stokes Equation; Angles (Geometry); Computational Fluid Dynamics; Delta Wings; Oscillations; Pressure Measurement

20010009860 National Aerospace Lab., Amsterdam, Netherlands
LOW SPEED STRAKED DELTA WING
Geurts, Evert G. M., National Aerospace Lab., Netherlands; Verification and Validation Data for Computational Unsteady Aerodynamics; October 2000, pp. 437-451; In English; See also 20010009839; Copyright Waived; Avail: CASI; A03, Hardcopy

Straked wings have become common features of advanced fighter-type aircraft. The strakes are designed to generate vortices from their highly swept leading edges, which stabilize the flow over the wing and provide additional lift up to high angles of attack. In this way the strakes contribute much to a high maneuverability. The vortex lift capability of straked wings has been extensively explored and experimental data concerning aerodynamic loading are available for various planforms and Mach numbers. The knowledge of unsteady loading on straked wings is less developed, both in the cases where the loading is due to wing oscillations - as required for aircraft stability and flutter analysis - and in cases where fluctuations in the flow are induced by vortex burst (or vortex breakdown) - as required for stall and buffet predictions. Some physical aspects of the unsteady vortex flow are described briefly below Vortices are shed from the leading edges of the strake and the wing. The sharp leading edges generate vortex sheets, even at low incidence, which roll up spirally into the strake vortices and flow downstream over the wing. The vortices induce strong lateral velocities at the strake and wing upper surface, giving rise to suction peaks at the position of the vortex cores. When the lateral velocities are large enough, secondary flow separations occur, leading to secondary vortices spiralling opposite to the primary vortices. At moderate incidences vortex sheets start to develop from the wing leading edges, starting at the kinks. At higher incidences vortex burst or vortex breakdown occurs, initially for the wing vortices, followed by the strake vortices. An important consequence of vortex burst is that the corresponding suction peaks become weaker and that the vortices lose their ability to produce additional lift. A normal behaviour of vortex burst is that it will move upstream when the incidence increases. At still higher incidences large-scale boundary layer or stall separation occurs, starting often at the trailing edge. The explanation of the above vortex flow becomes increasingly complicated in case of interactions of strake and wing vortices, their influence on vortex burst and flow separation and, at high enough speeds their interactions with shock waves. When the straked delta wing is oscillating, the strength and the position of the wing and strake vortices will oscillate. As the vortices are being fed through the vortex sheets emanating from the leading edges, it is to be expected that the oscillations of vortex strength and position will lag the wing oscillation. Some phenomena can be distinguished in the results of the steady measurements, at some characteristic incidence ranges: . up to 9 deg attached ('linear') flow; 9 deg to 19 deg fully developed vortex flow; 19 deg to 38 deg vortex burst extending from trailing edge; beyond 38 deg vortex burst penetrating the strake, almost fully stalled flow For the data selection

special interest was placed on incidences which mark transition of flow characteristics, or were typical for the flow characteristics in some incidence range. These incidences were 9 deg, 19 deg, 22 deg, 36 deg and 42 deg. Alpha= 9 deg attached flow; alpha = 19 deg onset to vortex burst; alpha = 22 deg burst vortex flow; alpha = 36 deg maximum CN, change of 180 deg in phase angle of unsteady pitching; alpha = 42 deg fully separated flow. The above values are the correct geometric incidences as are included in the database files; in the data point overview adjusted values are indicated. For the above characteristic values of incidence a large number of test conditions was explored. Though there is a full-span model, and conditions for plus and minus 5 degrees side-slip are expected to give the same results, both cases are included, because pressure transducers were situated only in the right half-wing. Both conditions are necessary to understand side-slip effects.
Author
Low Speed; Delta Wings; Aerodynamic Loads; Aircraft Stability; Buffeting; Flow Characteristics; Flutter Analysis; Wing Oscillations

20010009861 National Aerospace Lab., Amsterdam, Netherlands
TRANSONIC SIMPLE STRAKED DELTA WING
Geurts, Evert G. M., National Aerospace Lab., Netherlands; Verification and Validation Data for Computational Unsteady Aerodynamics; October 2000, pp. 453-472; In English; See also 20010009839; Copyright Waived; Avail: CASI; A03, Hardcopy

The unsteady transonic flow during maneuvers of fighters is not very well understood. For instance, large time delays and severe dynamic overshoots in normal force may occur, which cannot be predicted accurately by numerical methods. As a consequence, to be conservative structures must be over-designed or flight envelopes must be unnecessarily restricted. Therefore, a better understanding of the unsteady transonic flows, which occur during maneuvers, is of interest for the development and operation of fighters. This data set relates to an unsteady transonic wind tunnel test, on a highly instrumented semi-span simple straked delta wing model. Harmonic pitch as well as maneuver simulations were performed. The objectives of the test were: . To develop a better understanding of the physics of the unsteady vortex flow about a simple straked delta wing, . The generation of a steady and unsteady airloads database for the use in the validation of CFD codes. A first selection of test data for the validation of unsteady CFD codes related to this test is given in the following table and is motivated below. For harmonic oscillation the selected data points were chosen to highlight: . Vortex flow breakdown . Onset to Shock-Induced Trailing Edge Separation (SITES) and leading edge separation at transonic speeds.
Author
Transonic Speed; Delta Wings; Unsteady Flow; Numerical Analysis; Computational Fluid Dynamics; Fillers

20010028477 DaimlerChrysler Aerospace A.G., Military Aircraft, Munich, Germany
LOADS MONITORING AND HUMS
Guenther, G., DaimlerChrysler Aerospace A.G., Germany; Aging Aircraft Fleets: Structural and Other Subsystem Aspects; March 2001, pp. 1-1 - 1-16; In English; See also 20010028476; Copyright Waived; Avail: CASI; A03, Hardcopy

The fatigue life of aircraft in service is different from the design life for many weapon systems not only due to the extended need for the airframe as a platform for new/upgraded systems (life extension), but also due to different usage compared to the initial design spectrum. Monitoring of the life consumption is therefore essential to assess practicability and cost effectiveness of planned upgrades and modifications. Methods and concepts to establish the 'used life' are described for two different types of fixed wing aircraft and the influence of aircraft missions and equipment as well as structural weight increase over time are discussed. New integrated health monitoring systems with intelligent data processing and software capable comparing actual events or accumulated damage/wear with predefined limits, evaluate their criticality and provide information to other systems are presented.
Author
Aircraft Configurations; Fatigue Life; Airframes; Structural Weight; Weapon Systems; Loads (Forces)

20010028478 Aeronautical Systems Div., Wright-Patterson AFB, OH USA
AGING SYSTEMS AND SUSTAINMENT TECHNOLOGY
Lincoln, John W., Aeronautical Systems Div., USA; Aging Aircraft Fleets: Structural and Other Subsystem Aspects; March 2001, pp. 2-1 - 2-12; In English; See also 20010028476; Original contains color illustrations; Copyright Waived; Avail: CASI; A03, Hardcopy

Fatigue is a failure mode in aircraft that emerged in the fifties and sixties as a significant threat to their structural integrity. Since that time, the research community has extensively studied the phenomenon and has developed the technology to describe the propagation of fatigue cracks in a structure. This paper describes an approach that, when followed, will virtually eliminate catastrophic failures from this mechanism.
Author
Failure Modes; Structural Failure; Aircraft Structures; Aging (Materials)

20010028481 Aeronautical Systems Div., Wright-Patterson AFB, OH USA
RISK ASSESSMENTS OF AGING AIRCRAFT
Lincoln, John W., Aeronautical Systems Div., USA; Aging Aircraft Fleets: Structural and Other Subsystem Aspects; March 2001, pp. 5-1 - 5-19; In English; See also 20010028476; Original contains color illustrations; Copyright Waived; Avail: CASI; A03, Hardcopy

The USAF believes the damage tolerance approach incorporated in ASIP process in the seventies is still the cornerstone for protecting the safety of our aging aircraft. This process is primarily deterministic in that the calculations do not quantify the reliability of the process. As indicated above, however, the reliability achieved is consistent with the new aircraft guidance identified in USAF structural specification. The USAF derives the Force Structural Maintenance Plan (FSMP) from the damage tolerance assessment (DTA). The FSMP prescribes for the maintainer how, when, and where to perform inspections to maintain safety of flight. There are cases, however, where probabilistic methods need to be used. It is the purpose of this paper to illustrate the use of probabilistic methods to ensure structural integrity.
Derived from text
Aging (Materials); Risk; Structural Failure; Aircraft Structures; Airframes

20010028482 Italian Air Force, Chemistry Dept. of CSV, Rome, Italy
OCCURRENCE OF CORROSION IN AIRFRAMES
Colavita, M., Italian Air Force, Italy; Aging Aircraft Fleets: Structural and Other Subsystem Aspects; March 2001, pp. 6-1 - 6-10; In English; See also 20010028476; Original contains color illustrations; Copyright Waived; Avail: CASI; A02, Hardcopy

Degradation of the mechanical properties of a material interacting with the environment is probably the best and widest definition for corrosion. In particular, as mechanical properties are the driving forces in the design of military aircraft, corrosion in airframes must be considered as a major problem because it directly affects safety, economic and logistic issues. Considering the variety of materials, environments and mechanical stresses involved in the aeronautical field, it represents one of the areas where the largest spectrum of corrosion types is observed. Many classification can be used to categorize aircraft corrosion phenomena: wet or dry corrosion depending on the environment, time dependent or time independent phenomena, mechanically or not mechanically assisted corrosion failures, etc.; all of them are useful to understand the main cause of the observed corrosion case and consequently to apply the most adequate corrective actions. The purpose of this lecture is to provide an overview on the most common forms of corrosion experienced in the past, in order to present a wide range of severity arising from cosmetic to catastrophic failures. Particular attention will be given to the corrosion aspects related with aging aircraft issues.
Derived from text
Airframes; Corrosion; Degradation; Mechanical Properties; Aircraft Design

20010028485 DaimlerChrysler Aerospace A.G., Military Aircraft, Munich, Germany
AIRCRAFT LOADS
Neubauer, M., DaimlerChrysler Aerospace A.G., Germany; Guen-

ther, G., DaimlerChrysler Aerospace A.G., Germany; Aging Aircraft Fleets: Structural and Other Subsystem Aspects; March 2001, pp. 9-1 - 9-19; In English; See also 20010028476; Original contains color illustrations; Copyright Waived; Avail: CASI; A03, Hardcopy

The life of a weapon system is influenced to a high degree by the structural integrity of the airframe. Numerous programs to ensure this have been established within NATO's Air Forces. Structural loads, leading to fatigue as well as corrosion, depending on the usage environment, are the major reason for degradation of structures. The many different classes of loads, the generation of loading conditions during the design phase, as defined in the weapons systems specification, consideration of static and fatigue loads for structural lay-out and validation concepts are presented. The procedure of converting overall aircraft loads ('external loads') into individual component loads is shown in principal.
Derived from text

Airframes; Loads (Forces); Structural Failure; Weapon Systems; Degradation

20010028486 Italian Air Force, Chemistry Dept. of CSV, Rome, Italy
PREVENTION AND CONTROL IN CORROSION
Colavita, M., Italian Air Force, Italy; Aging Aircraft Fleets: Structural and Other Subsystem Aspects; March 2001, pp. 11-1 - 11-6; In English; See also 20010028476; Copyright Waived; Avail: CASI; A02, Hardcopy

Aircraft corrosion is a never-ending challenge where prevention and control play the fundamental role of ensuring the airworthiness requested. Corrosion prevention moves from design optimization and proper material selection, but it includes much more following phases like a correct finish specification and plans for effective maintenance, inspection and repair. Corrosion control, in this meaning including prediction and diagnostics, is complementary to prevention and it is actually the field where more efforts are provided, because early corrosion detection is the easiest way to avoid costly aircraft damage or failures. In effect, considering that corrosion can account for 60% of all maintenance and repair costs, economic factors must be considered as the most important constraint affecting both prevention and control. In this lecture the attention will be focused on the different corrosion prevention and control strategies adopted and their actual modifications in accordance with the exacerbation of the aging aircraft issues.
Author

Corrosion; Corrosion Prevention; Aircraft Reliability; Detection; Diagnosis; Inspection

20010028491 Aeronautical Systems Div., Wright-Patterson AFB, OH USA
MATERIAL AND PROCESS TECHNOLOGY TRANSITION TO AGING AIRCRAFT
Lincoln, John W., Aeronautical Systems Div., USA; Aging Aircraft Fleets: Structural and Other Subsystem Aspects; March 2001, pp. 16-1 - 16-10; In English; See also 20010028476; Copyright Waived; Avail: CASI; A02, Hardcopy

A method is described that may be used to help ensure that a structural material or process will be successful when transitioned from the laboratory for replacement of existing materials and processes in an aging aircraft. Experience with laboratory and aircraft development programs has shown that five factors are essential for success in the technology transition process. An example is shown where the transition using this process was successful.
Derived from text

Aging (Materials); Aircraft Design; Aircraft Structures; Airframes

20010067705 Boeing Co., Long Beach, CA USA
LANDING APPROACH FLYING QUALITIES CRITERIA FOR ACTIVE CONTROL TRANSPORT AIRCRAFT
Field, Edmund J., Boeing Co., USA; Rossitto, Kenneth F., Boeing Co., USA; Mitchell, David G., Hoh Aeronautics, Inc., USA; Active Control Technology for Enhanced Performance Operational Capabilities of Military Aircraft, Land Vehicles and Sea Vehicles; June 2001, pp. 33-1 - 33-13; In English; See also 20010067671; Copyright Waived; Avail: CASI; A03, Hardcopy

Flying qualities databases and criteria have existed for fighter aircraft for several decades. However, there have been a lack of databases and criteria for active control transport aircraft. During the 1990's Boeing undertook a series of in-flight simulation experiments to generate a comprehensive longitudinal axis database for transport aircraft in the landing approach task. This database has subsequently been applied to the more established longitudinal flying qualities criteria that were developed for fighter aircraft. This paper summarizes the results of these analyses and appraises the performance of the various criteria for application to active control transport aircraft.
Author

Active Control; Data Bases; Transport Aircraft; Flight Characteristics

20010067708 Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Inst. of Structural Mechanics, Brunswick, Germany
A CONCEPT OF A SHAPEVARIABLE FOWLER FLAP ON TRANSPORT AIRCRAFT
Anhalt, Christian, Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; Breitbach, Elmar, Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; Sachau, Delf, Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; Active Control Technology for Enhanced Performance Operational Capabilities of Military Aircraft, Land Vehicles and Sea Vehicles; June 2001, pp. 6-1 - 6-8; In English; See also 20010067671; Original contains color illustrations; Copyright Waived; Avail: CASI; A02, Hardcopy

This paper presents a part of the major project 'Adaptive Wing (ADIF)' of the partners German Aerospace Center (DLR), DaimlerChrysler Research, and DaimlerChrysler Aerospace Airbus. Using the Airbus A330/340 fowlerflap as an example, the objective of this project is to show how the high lift behavior of modern transport aircraft can be improved by intelligent structural concepts, without negative effects on cruise flight. Even an improvement in transonic flight is possible. For this, a combination of passive and active measures is necessary, as the following paper shows.
Author

Structural Design; Transport Aircraft; Active Control; Wings

20010067715 Deutsches Zentrum fuer Luft- und Raumfahrt e.V., Inst. of Aeroelasticity, Wessling, Germany
OPTIMIZATION OF THE PASSIVE SHOCK ABSORBER OF A MILITARY AIRCRAFT
Uhrmeister, Bernd, Deutsches Zentrum fuer Luft- und Raumfahrt e.V., Germany; Active Control Technology for Enhanced Performance Operational Capabilities of Military Aircraft, Land Vehicles and Sea Vehicles; June 2001, pp. 16-1 - 16-11; In English; See also 20010067671; Copyright Waived; Avail: CASI; A03, Hardcopy

For a large military transport the potential is assessed to improve its behavior during touch down and ground run by optimization landing gear parameters. Four oleo force parameters were chosen for the optimization: the damping coefficients at compression and expansion, the pre-load, and the length of the gas spring. With respect to feasibility the variation of the parameters is restricted to a band of 20% about the nominal value. The aim of the optimization is the reduction of the vertical acceleration at touchdown. During ground roll the ride index has to be minimized. Touch down and ground run were first treated separately. Thus a basis is provided to assess whether switching the damping can satisfy the requirements of both phases. In addition the complete cycle from touch down to roll out was investigated. Concerning the results: It is to be observed that the optimal performance is achieved with the parameters at their limits. The performance in terms of reduction of acceleration, respectively improvement of ride comfort is enhanced by an amount between 20% and 30%.
Author

Shock Absorbers; Touchdown; Optimization; Aircraft Landing

20010082331 European Aeronautic Defence and Space Co., Munich, Germany
CONSEQUENCES FOR THE DESIGN OF MILITARY AIRCRAFT SYSTEMS DUE TO INTEGRATION OF COMMERCIAL ELECTRONIC COMPONENTS IN AVIONICS
Cernko, E., European Aeronautic Defence and Space Co., Germany; Jaeger, D., European Aeronautic Defence and Space Co., Germany; Manser, R., European Aeronautic Defence and Space Co., Germany; Strategies to Mitigate Obsolescence in Defense Systems Using Commercial Components; June 2001, pp. 5-1 - 5-10; In English; See also 20010082326; Original contains color illustrations; Copyright Waived; Avail: CASI; A02, Hardcopy

The time when aerospace requirements and investments initiated microelectronic components development has passed. Industries like Telecom and Personal Computer invest many times more than aerospace with huge economical, performance, size, mass, packaging, and assembly improvements. The lifespan of these developments in the market is very short. The Life Cycle Costs for keeping up avionics design with special ruggidised components and designs is likely to be higher than to adapt a military aircraft and their periphery to avionics with non-ruggid electronic components. There are technical solutions available to adapt the military avionics environment to the requirements of nonruggid electronic components ad designs. This paper describes the relevant environmental aspects in nowadays military aircraft designs, which have to be considered and their relation to non-ruggid electronics. Further on this paper describes some possible modifications of military aircraft designs to cope with the environmental requirements of non-ruggid electronics.
Author
Microelectronics; Aircraft Design; Electronic Equipment

20020024644 Research and Technology Organization, Systems Concepts and Integration Panel, Neuilly-sur-Seine, France
FLYING QUALITIES FLIGHT TESTING OF DIGITAL FLIGHT CONTROL SYSTEMS, VOLUME 21 ***[LES ESSAIS EN VOL DES PERFORMANCES DES SYSTEMES DE COMMANDE DE VOL NUMERIQUES], VOLUME 21***
Webster, F., Air Force Flight Test Center, USA; Smith, T. D., BAE Systems, UK; December 2001; 124p; In English; CD-ROM contains full text in PDF format
Report No.(s): RTO-AG-300-Vol-21; AC/323(SCI-034)TP/39-Vol-21; ISBN 92-837-1075-4; Copyright Waived; Avail: CASI; C01, CD-ROM; A06, Hardcopy; A02, Microfiche

This document covers the basics of flying qualities flight testing for digital flight control systems. Most of the techniques and subjects discussed also apply to analog systems as well. The techniques discussed are by no means the only techniques available, nor are they necessarily applicable to every flight test program. Rather, they are a collection of best practices from organizations across NATO, which practice the subject matter. The author hopes that the contents of this text will provide a comprehensive overview of the subject appropriate for experienced engineers, as well as provide a learning source for those new to the subject matter.
Author
Flight Control; Flight Tests; Systems Engineering; Flight Characteristics; Digital Systems; Analog Data

06
AVIONICS AND AIRCRAFT INSTRUMENTATION

19990040723 Naval Air Warfare Center, Aircraft Div., Patuxent River, MD USA
DEVELOPMENT, TEST AND INTEGRATION OF THE AGM-114 HELLFIRE MISSILE SYSTEM AND FLIR/LASER ON THE H-60 AIRCRAFT
Roberts, D., Naval Air Warfare Center, USA; Capezzuto, R., Naval Air Warfare Center, USA; Aircraft Weapon System Compatibility and Integration; April 1999, pp. 12-1 - 12-12; In English; See also 19990040714; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

The Hellfire Missile System (HMS) and a nose mounted FLIR with laser designator system were selected as integration candidates on H-60 derivatives based on a new fleet weapons requirement. Naval Air Warfare Center Aircraft Division (NAWCAD) Patuxent River conducted ground and flight tests to structurally qualify the HMS and FLIR systems and evaluate their integration into the H-60 airframe. Three ground firings and 45 hours of flight test (including six missile firings and eight launcher jettisons) were conducted in 1995 during the technical feasibility phase and 60 test flight hours were flown in 1997 during the system integration phase. In-flight jettison and missile firing test planning utilized a six degree-of-freedom simulation to develop the minimum number of test points to clear the desired envelope while managing risk. Testing demonstrated the successful structural integration of the HMS and FLIR systems. Testing then proceeded with integration of the functional FLIR and HMS. The integration test program fired 6 missiles at fixed and moving targets, under day and night conditions over land and water using the FLIR/LASER for tracking and autonomous designation. Integration development and testing utilized specialized U.S. Army Hellfire instrumentation as well as the Laser Designator Weapons System Simulator (LDWSS) modeling tool. LDWSS was used to simulate launch conditions and engagement scenarios, predict missile launch transients and trajectories, and identify launch constraint and laser self-designation issues. The simulation tools and test methods employed minimized test flights and required assets, resulting in an efficient certification of this weapon system for fleet use.
Author
H-60 Helicopter; Missile Systems; Systems Integration; Weapons Delivery; Flight Tests; Ballistic Trajectories; Ground Tests; Systems Compatibility; Computerized Simulation; External Store Separation

20000037810 Litton Guidance and Control Systems, Northridge, CA USA
A MODERN INTEGRATED AVIONICS SYSTEM FOR THE NEXT GENERATION U.S.M.C. ATTACK AND UTILITY HELICOPTERS
Dowell, John A., Litton Guidance and Control Systems, USA; Wade, Ronald C., Naval Air Systems Command, USA; Advances in Vehicle Systems Concepts and Integration; April 2000, pp. A12-1 - A12-12; In English; See also 20000037804; Copyright Waived; Avail: CASI; A03, Hardcopy

The USA Marine Corps awarded the first phase of the H-1 platform upgrade program to Bell Helicopter in late 1996. This effort resulted in substantial improvements to both the AH-1 Gunship and UH-1 Utility aircraft. Upgrades included a new transmission and a 4-bladed rotor with resulting improvements in mission effectiveness and cost of ownership. In 1997, the program was expanded to provide a modern suite of avionics incorporating improved sensors, cockpits, weapons processing, helmet-mounted displays and an advanced centralized mission processing subsystem. This technical paper will review the basis for architectural decisions of the avionics and the criteria for selection of key sensors and displays. Major attributes of redundancy and commonality are described, together with an overview of an advanced open architecture mission computer.
Author
Avionics; Attack Aircraft; Upgrading

20000037813 Societe d'Applications Generales d'Electricite et de Mecanique, Defense and Security Div., Nanterre, France
MODULAR AVIONICS UPGRADE: THE COST EFFECTIVE SOLUTION TO ADAPT EXISTING FIGHTERS TO THE OPERATIONAL REQUIREMENTS OF TODAY'S BATTLEFIELD
Dedieu, Christian, Societe d'Applications Generales d'Electricite et de Mecanique, France; Loffler, Eric, Societe d'Applications Generales d'Electricite et de Mecanique, France; Advances in Vehicle Systems Concepts and Integration; April 2000, pp. A15-1 - A15-4; In English; See also 20000037804; Copyright Waived; Avail: CASI; A01, Hardcopy

This paper presents already fielded implementations of an avionics upgrade package developed to offer a modular solution to a wide range of modem operational requirements. The SAGEM SA upgrade concept allows to match specifications ranging from basics performance enhancement, such as high accuracy navigation for low level flight, up to full multi-role capability with sophisticated air-to-surface weapon delivery and multi-target air-to-air fire control. The upgraded system implements all state of art features available on the most recent fighters, particularly for pilot interface (HOTAS, glass cockpit, NVG compatibility, ...) as well as for system architecture (modular avionics, high level of redundancy and back-up modes, ADA HOL programming, object oriented software ...). The presentation will describe how the most recent technologies can be inducted in older platforms more rapidly than on newly developed airframes, therefore ensuring that the most demanded operational requirements are fully satisfied. In particular, sensor technologies (pulse-Doppler Radar, thermal imaging and IRST ...) will be addressed, as well as smart weapons (guidance kits, advanced tire control software ...) which are driving factors for the overall accuracy for the success of the mission. A special highlight will be given on ground support equipment and procedures both at operational and maintenance levels. These facilities include part-task trainers and mission planning systems to help the pilots optimize their missions; in parallel an

integrated logistic support is deployed to give all necessary tools to the maintenance crews.
Author
Avionics; Upgrading; Fighter Aircraft; Systems Engineering

20000037898 Societe Nationale de Construction Aeronautique, Gosselies, Belgium
THE B-HUNTER UAV SYSTEM
Delonge, Robert, Jr., Societe Nationale de Construction Aeronautique, Belgium; Development and Operation of UAVs for Military and Civil Applications; April 2000, pp. 11-1 - 11-17; In English; See also 20000037887; Copyright Waived; Avail: CASI; A03, Hardcopy

The purpose of this paper consists to provide a general overview of the B-HUNTER UAV System that has been chosen by the Belgian Army Ground Forces. From year 2001, the B-HUNTER UAV system will replace the Epervier UAV System which was in use in the Belgian Army since more than 20 years. The B-HUNTER UAV System is derived from the US Short Range HUNTER Tactical UAV that has been developed and qualified according to the most severe NATO requirements by a joint venture composed of Israel Aircraft Industries Ltd. (IAI) and TRW Inc. It has been recently successfully deployed in Kosovo operation with proven operational results that have been reported in profusion of press releases. This paper will describe the main upgrades at system and subsystem level that will be performed in the frame of the Belgian Contract by the Belgian EAGLE Temporary Association. The B-HUNTER UAV system and subsystem are described. In the course of the B-HUNTER UAV Program, a lot of attention will be paid to the potential integration of the B-HUNTER UAV System in the civil air space. According to the Belgian law, UAV Systems have to comply with the following overall safety objective: 'The B-HUNTER UAV System must allow during all its life safely execution of UAV missions above populated areas taking into account Belgian environmental conditions'. A short introduction to the activities performed in the frame of the B-HUNTER UAV program with regards to airworthiness issues is presented.
Author
Pilotless Aircraft; Aircraft Reliability; Aircraft Industry; Aircraft Design

20010002551 Air Force Research Lab., Wright-Patterson AFB, OH USA
AGING AVIONICS: A SCIENCE AND TECHNOLOGY CHALLENGE OR ACQUISITION CHALLENGE?
Ostgaard, John, Air Force Research Lab., USA; Carbonell, Juan, Air Force Research Lab., USA; Benning, Stephen, Air Force Research Lab., USA; Aging Engines, Avionics, Subsystems and Helicopters; October 2000, pp. 4-1 - 4-15; In English; See also 20010002548; Copyright Waived; Avail: CASI; A03, Hardcopy

The fleet of aircraft which we have today represents 90% of the aircraft which we will have well into the next century. With defense budgets shrinking, fewer new aircraft will be purchased. Avionics modernization is the highest leveraged approach to maintain and increase capability. This treatise discusses the problems associated with our existing fleet of aircraft, both from a maintenance and modernization perspective. Examples of obsolescence and retrofit issues are provided to highlight the seriousness of the problem.
Author
Avionics; Aircraft Maintenance; Technology Utilization; Aging (Materials); Upgrading; Maintainability

20010082339 Elektronik-System G.m.b.H., Fixed Wing Aircraft, Munich, Germany
TRANSITIONING TO INTEGRATED MODULAR AVIONICS WITH A MISSION MANAGEMENT SYSTEM
Gangkofer, M., Elektronik-System G.m.b.H., Germany; Kader, H., Elektronik-System G.m.b.H., Germany; Kloeckner, W., Elektronik-System G.m.b.H., Germany; White, C. G., Elektronik-System G.m.b.H., Germany; Strategies to Mitigate Obsolescence in Defense Systems Using Commercial Components; June 2001, pp. 15-1 - 15-12; In English; See also 20010082326; Copyright Waived; Avail: CASI; A03, Hardcopy

This paper presents an incremental approach towards the adoption of an Integrated Modular Avionics (IMA) architecture, via the implementation of a Mission Management System using present-day Commercial Off-the-Shelf (COTS) technology. While standardized IMA modules are planned to be developed in the medium term, the approach presented enables the maximum benefits to be obtained from those aspects of the IMA concepts which are the most advanced, while exploiting the availability of today's COTS hardware. This approach is embodied in the Mission Management System, which is under development at ESG. The paper first presents the approach adopted in transitioning towards the IMA architecture via the use of current-day COTS components. The Mission Management System is then described from the system architecture, software architecture, and hardware architecture points of view, noting the implementation constraints of current COTS components. The system characteristics which are achieved through the adoption of the relevant IMA principles together with open systems and COTS practices are presented. The mission management functions to be implemented on the system are defined, and an example is then presented of a complete avionics system built using the transitional technology of the Mission Management System in a number of Integrated Computers to provide a complete computing core. Some certification issues are discussed, and the adoption of an incremental certification approach is recommended. A path forward towards the development of a true IMA system implementation is proposed, including further development of the Mission Management System, and the migration to a modular implementation.
Derived from text
Architecture (Computers); Management Systems; Commercial Off-The-Shelf Products

20010082340 BAE Systems, Sensor Systems Div., Edinburgh UK
AVIONICS ARCHITECTURE STANDARDS AS AN APPROACH TO OBSOLESCENCE MANAGEMENT
Jibb, D. J., BAE Systems, UK; Walker, J. B., BAE Systems, UK; Strategies to Mitigate Obsolescence in Defense Systems Using Commercial Components; June 2001, pp. 16-1 - 16-12; In English; See also 20010082326; Copyright Waived; Avail: CASI; A03, Hardcopy

Obsolescence management techniques can be categorized as either production engineering based techniques that attempt to control an existing situation or design based approaches that attempt to minimize the initial problem. This paper addresses system architecture design as an approach to obsolescence management. The work of the ASAAC program in developing open architecture standards designed to exhibit a high level of obsolescence robustness is described. Other issues that relate to the financing and organization of obsolescence management are also discussed.
Author
Architecture (Computers); Management Methods; Technology Utilization; Military Technology

20010082342 European Aeronautic Defence and Space Co., Munich, Germany
INTEGRATED MODULAR AVIONICS WITH COTS DIRECTED TO OPEN SYSTEMS AND OBSOLESCENCE MANAGEMENT
Grabowski, G., European Aeronautic Defence and Space Co., Germany; Balser, B., European Aeronautic Defence and Space Co., Germany; Foerster, M., European Aeronautic Defence and Space Co., Germany; Strategies to Mitigate Obsolescence in Defense Systems Using Commercial Components; June 2001, pp. 18-1 - 18-9; In English; See also 20010082326; Original contains color illustrations; Copyright Waived; Avail: CASI; A02, Hardcopy

This paper describes how to design open computer systems for mission critical applications within the avionics of military aircraft using 'Commercial Off The Shelf' (COTS) computer components. Design aspects of Integrated Modula Avionics (IMA) are incorporated. How these aspects contribute to an effective obsolescence management is also described. The content of this paper is presented within the context of projects currently running at the European Aeronautic Defence and Space (EADS) Deutschland GmbH, Military Aircraft Business Unit (MABU), which are dealing with the subjects of COTS and obsolescence. First the primary design aspects of open computer systems will be discussed as well as internationally recognized associations and standards dealing with this topic. The potential behind the use of open computer systems for future avionics of military aircraft is to be unveiled. It will be described how to set up open computer systems, considering IMA conform design aspects, which fulfill the requirements directed to the equipment of mission critical avionics in military aircraft. Within this context the core aspects of IMA will be introduced and compared to conventional systems. The use of COTS computer hardware (HW)

and software (SW) will be presented as a cost effective solution for setting up open computer-systems for use in aircraft, until ASAAC conform HW and SW solutions are available. Possible COTS based configurations will be discussed referring to a current COTS computer system. This system is ruggedized for flight and built up with COTS HW and run by a COTS real time operating system. Successful flight-testing of the system has taken place. Due to the rapid developing IT technology, today's computer systems quickly face obsolescence. Avionics for military aircraft are especially vulnerable because of the long development cycles. The opportunities of managing obsolescence, given by the use of COTS computer HW and SW, are identified with respect to future avionics of military aircraft. Affected qualification and flight-clearance aspects as well as the porting of avionics SW applications, originally developed for proprietary computer systems, onto COTS computer systems will be mentioned.
Author
Avionics; Systems Management; Commercial Off-The-Shelf Products; Computer Programs

20010082343 Italian Air Force, Official Flight Test Centre, Rome, Italy
MB-339CD AIRCRAFT DEVELOPMENT COTS INTEGRATION IN A MODERN AVIONICS ARCHITECTURE
Sabatini, R., Italian Air Force, Italy; Massari, M., Aermacchi S.p.A., Italy; Strategies to Mitigate Obsolescence in Defense Systems Using Commercial Components; June 2001, pp. 19-1 - 19-9; In English; See also 20010082326; Original contains color illustrations; Copyright Waived; Avail: CASI; A02, Hardcopy

Obsolescence of electromechanical instruments and navigation sensors is one of the main reasons for new avionics development in military training aircraft upgrade programs. The growing requirements for advanced trainers in the role of lead-in-fighter aircraft push the development of integrated avionics system where cockpit displays, mission computer, solid-state navigation sensors, communication transceivers and flight data recorders are extensively employed. The use of COTS (Commercial Off The Shelf) solutions allows to mitigate components obsolescence and to meet the new operational requirements at an affordable cost with reasonable development risk. The purpose of this paper is to provide an overview of how these concepts have been applied in the development of an innovative, modular and reliable avionics system. The latest version of the proven MB-339 twin seat jet powered advanced trainer employs a modern state-of-the-art avionics architecture based on standard bus interface (i.e., MIL-STD-1553 and ARINC 429), capable to easily integrate COTS equipment. The system exhibits a full glass cockpit with three identical and interchangeable Multifunction Displays, Head-up Display and independent get-home instrumentation for back-up flight data presentation: all the cockpit displays use COTS active matrix full colour high resolution LCD's. COTS solutions are applied at hardware level in computer processing, interface and memory devices, providing state-of-the-art high performance digital technology solutions. Radio navigation equipment, air data computer and an embedded inertial-GPS platform are employed as proven, off-the-shelf and fully qualified military equipment. The paper highlights the advantages gained by the employment of COTS solutions in a modern, flexible, and expandable avionics architecture. In the paper, the equipment is deliberately described in general terms, omitting any manufacturer reference.
Author
Avionics; Commercial Off-The-Shelf Products; Technology Utilization

20010082349 European Aeronautic Defence and Space Co., Airborne Systems, Ulm Germany
A CONSIDERATION OF OBSOLESCENCE WITHIN THE DESIGN OF MODERN AVIONICS TEST SYSTEMS
Bach, Rainer, European Aeronautic Defence and Space Co., Germany; Mayer, Thomas, European Aeronautic Defence and Space Co., Germany; Charbonnier, Paul, European Aeronautic Defence and Space Co, France; Strategies to Mitigate Obsolescence in Defense Systems Using Commercial Components; June 2001, pp. 25-1 - 25-8; In English; See also 20010082326; Original contains color illustrations; Copyright Waived; Avail: CASI; A02, Hardcopy

Considering obsolescence in avionics systems firstly leads to the obsolescence of the so called prime equipment. This means the equipment of which an avionics system is built. Normally the support equipment is more or less ignored or the analysis is postponed to a later date. We analyzed today's situation and differentiated our analysis in the (commercial off the shelf) market, customer requirements, and technology. During our analysis we decided to not only analyze the obsolescence situation within the test systems design, because obsolescence within the design of modern avionics test systems is only one of the determining factors. All factors have to he merged into a design concept inside of which single factors can't be considered stand alone. Our solution - covering the requirements of the end user of our systems - consists of a design concept covering the test systems critical interfaces, test system standards, and the philosophy of standardized units. This approach ensures the flexibility in hardware and software to adapt quickly as needed on the commercial market and to guarantee the long term support as needed on the military market. The approach is adaptable to various maintenance and service concepts providing each customer (nation) with its own In-Service concept supporting mobile and fixed service stations. We are convinced that our concept ultimately benefits to our customer without ignoring the interests of industry.
Author
Avionics; Standardization; Systems Management

07
AIRCRAFT PROPULSION AND POWER

19990032472 NASA Ames Research Center, Moffett Field, CA USA
SOLAR POWERED STRATOSPHERIC RESEARCH AIRCRAFT: FLIGHT TEST AND SYSTEM IDENTIFICATION
Lisoski, Derek L., AeroVironment, Inc., USA; Tischler, Mark B., NASA Ames Research Center, USA; System Identification for Integrated Aircraft Development and Flight Testing; March 1999, pp. 27-1 - 27-10; In English; See also 19990032449; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

On July 7th, 1997, the NASA Pathfinder solar-powered aircraft flew to a record altitude of 71,500 feet; establishing new world altitude records for electric powered and propeller-driven aircraft. The Pathfinder platform, developed by AeroVironment for NASA's Environmental Research Aircraft and Sensor Technology (ERAST) program, is an unmanned solar-powered flying wing which serves as the first of a series of technology demonstrators which are slated to include the 100,000 ft attitude Centurion and the multi-week duration Helios solar aircraft. During the 1997 flight test deployment at the Pacific Missile Range Facility, Kauai, Hawaii, Pathfinder flew a total of six times, establishing the viability of a solar powered aircraft for scientific and commercial payload missions. During this flight test series, extensive use was made of the CIFER(R) frequency response analysis code for initial simulation verification, in-flight real-time stability determination, and post-flight system identification to ensure flight safety. This paper presents an overview of Pathfinder and the flight test program, outlines some of the analysis techniques used, and summarizes their results.
Author
System Identification; Flight Tests; Research Aircraft; Solar Powered Aircraft; Flight Control; Systems Engineering

19990070390 Research and Technology Organization, Applied Vehicle Technology Panel, Neuilly-sur-Seine, France
QUALIFICATION OF LIFE EXTENSION SCHEMES FOR ENGINE COMPONENTS *[HOMOLOGATION DES PROGRAMMES DE PROLONGATION DU CYCLE DE VIE DES ORGANES MOTEUR]*
March 1999; 172p; In English; 5-6 Oct. 1998, Corfu, Greece; See also 19990070391 through 19990070408
Report No.(s): RTO-MP-17; AC/323(AVT)TP/7; ISBN 92-837-1012-6; Copyright Waived; Avail: CASI; A08, Hardcopy; A02, Microfiche

Contains the papers presented at the Workshop on Qualification of Life Extension Schemes for Engine Components. The replacement cost of service-damaged components contributes significantly to the life cycle costs of an aero-engine. Damaged engine components also impact on the reliability and safety of aircraft. The papers discuss component damage management in turbines, including life management aspects of high cycle fatigue, and techniques for extending lives of service-damaged parts to achieve engine life

cycle cost reductions, without compromising safety. Operators' needs and benefits accruing from component life extension are discussed. Various technologies available to life cycle managers for component life extension are described. The technologies include surface modification treatments and coatings, repair and refurbishment procedures, as well as improved component life cycle management practices based on damage tolerance and inspection. Emphasis is placed on the qualification testing requirements that must be satisfied to ensure that repaired or modified parts, or parts for which new life cycle management practices are applied, remain safe and reliable when returned to service.
Author
Aircraft Engines; Cost Reduction; Engine Parts; Gas Turbine Engines; Aircraft Maintenance; Operating Costs; Service Life; Life Cycle Costs; Damage Assessment; Aircraft Safety; Conferences

19990070391 Atlantis Aerospace Corp., Brampton, Ontario Canada
AERO-ENGINE COMPONENT REPAIR/REPLACEMENT DECISION FACTORS
Hastings, R. R., Atlantis Aerospace Corp., Canada; March 1999; 6p; In English; See also 19990070390; Copyright Waived; Avail: CASI; A02, Hardcopy; A02, Microfiche

The high cost of ownership of military weapons systems coupled with shrinking defense budgets is encouraging the pursuance of alternative management strategies for cost control. Aero-engines which typically consume 30% of the life cycle costs of a fighter aircraft platform are a prime target for initiatives including: damage tolerant design practices, on-condition maintenance and the repair, refurbishment or rejuvenation of components as opposed to their replacement. While the foregoing issue address cost issues in a very direct manner, there are a number of other factors which may motivate owners of large fleets of aircrafts to pursue management by repair/refurbishment.
Author
Aircraft Engines; Fighter Aircraft; Life Cycle Costs; Cost Analysis; Failure Analysis; Aircraft Maintenance; Cost Reduction

19990070392 Bundesamt fuer Wehrtechnik und Beschaffung, Propulsion Systems Div., Manching, Germany
COST EFFECTIVENESS OF MODERN LIFTING CONCEPTS: CONSIDERATION OF ECONOMICAL ASPECTS CONCENTRATING ON GROUP A PARTS OF MILITARY AIRCRAFT ENGINES
Tschirne, K. U., Bundesamt fuer Wehrtechnik und Beschaffung, Germany; Holzbecher, W., Bundesamt fuer Wehrtechnik und Beschaffung, Germany; Qualification of Life Extension Schemes for Engine Components; March 1999; 9p; In English; See also 19990070390; Copyright Waived; Avail: CASI; A02, Hardcopy; A02, Microfiche

It is an usual approach of traditional lifing procedures to perform extensive and therefore costly spinning and laboratory tests with subsequent sampling programmes aiming at the maximum usage of fracture critical parts, so called group-Aparts. Experience on military programmes has shown that this approach does not take into account all the aspects related to the real in-service situation. In order to avoid engine removals and disassemblies due to life-expired parts, causing major expenses, it becomes necessary to retire parts when they become available on the basis of natural arisings, i. e. at the most economical and suitable point in time. The aim of the presentation is to encourage both the manufacturer and operator of military engines to instigate a detailed review of their current lifing policy as far as the remaining life at the point of retirement is concerned. Furthermore, some aspects concerning the philosophy of the required (desired) specified life for an engine and its components are highlighted.
Author
Cost Effectiveness; Aircraft Engines; Life (Durability)

19990070393 Standard Aero Ltd., Winnipeg, Manitoba Canada
INTERNATIONAL ACCEPTANCE OF COMMERCIAL REPAIR APPROVALS
Thomas, Wayne, Standard Aero Ltd., Canada; Junkin, Brent, Standard Aero Ltd., Canada; March 1999; 5p; In English; See also 19990070390; Copyright Waived; Avail: CASI; A01, Hardcopy; A02, Microfiche

As the military increasingly adopts commercial standards for the maintenance of 'dual use' aircraft, commercial repair approval and it's methodology is becoming increasingly relevant in the military world. Component repair development is not limited to the MANUFACTURER. The repair marketplace is global with independent facilities operating around the world.The authority to issue approvals for aeronautical product repair procedures lies with the National Aviation Authority (NAA). Some NAA's have implemented a system of delegation to enhance the efficiency and effectiveness of the approval process. The privileges and responsibilities of delegated authority may be granted to operators, independent repair stations, qualified individuals, or the manufacturer. This paper describes how the commercial system works to obtain approval for a new repair scheme, and describes some delegation systems.
Author
Aircraft Maintenance; Logistics; Checkout

19990070394 Air Force Research Lab., Materials and Manufacturing Technology Directorate, Wright-Patterson AFB, OH USA
HIGH CYCLE FATIGUE LIFE MANAGEMENT IN GAS TURBINE ENGINES
Nicholas, T., Air Force Research Lab., USA; March 1999; 9p; In English; See also 19990070390; Copyright Waived; Avail: CASI; A02, Hardcopy; A02, Microfiche

High Cycle Fatigue (HCF) failures in materials used in rotating components of gas turbine engines have often been found to be attributable to fatigue loading on materials which have sustained damage from other sources. Damage can be present in the form of initial material or manufacturing defects, or can develop during service operation. Three major sources of in-service damage have been identified which can alter the HCF resistance individually or in conjunction with one another: Low cycle fatigue (LCF), foreign object damage (fod) and fretting. Methodologies for treating such damage in establishing material allowables are considered. Some recent results on the effects of damage on the Haigh diagram and a discussion of the life management aspects of HCF are presented.
Author
Damage; Defects; Fatigue (Materials); Fatigue Life; Foreign Bodies; Gas Turbine Engines; Life (Durability); Engine Failure; Operational Hazards

19990070395 Rolls-Royce Ltd., Turbine Systems-Engineering, Bristol, UK
COST BENEFIT ANALYSIS FOR THE USE OF BETTER TURBINE MATERIALS AND TECHNOLOGY INCLUDING PREDICTED LIFE IMPROVEMENTS
Williams, T. J., Rolls-Royce Ltd., UK; March 1999; 6p; In English; See also 19990070390; Copyright Waived; Avail: CASI; A02, Hardcopy; A02, Microfiche

The new materials and technologies being identified to give an improved engine product have a number of interacting effects. For example, a more advanced turbine blade cooling system may offer improved performance and or life but may also increase the cost of each blade. Life cycle cost methods are used in the aero engine industry to establish the overall operating cost for a particular engine / airframe combination. As the name implies the total cost of operation of the engine over its scheduled service life can be established. This paper will demonstrate how the use of life cycle costing techniques at the early stage of life extension proposals can influence the design and lead to a more economic design solution. In the study the effect of initial costs (material and manufacture) were traded against performance and life improvement to optimize the most cost effective design. The results of the study have been used to identify what manufacturing cost reduction must be achieved to benefit fully from performance and life improvements during the overall life of the engine.
Author
Cost Effectiveness; Cost Reduction; Turbine Blades; Technology Assessment; Life (Durability); Service Life; Life Cycle Costs

19990070396 Vlaamse Instelling voor Technologisch Onderzoek, Mol, Belgium
LOW FRICTION DIAMOND-LIKE CARBON COATINGS FOR ENGINE APPLICATIONS
Smeets, J., Vlaamse Instelling voor Technologisch Onderzoek, Belgium; March 1999; 3p; In English; See also 19990070390; Copyright Waived; Avail: CASI; A01, Hardcopy; A02, Microfiche

The presentation discusses the low friction diamond-like carbon coatings and deposition methods for engine applications. The three types of coating types discussed are: (1) pure diamond-like Carbon, (2) doped diamond like carbon and (3) Gradient and multilayer coatings. The properties of each of the three coating types is reviewed. Six characteristics of vapor based deposition technology are discussed deposition methods are reviewed: (1) vacuum technology; (2) Physical Vapor Deposition (PVD), starting from solids; (3) Chemical vapor deposition, starting from gases; (4) flux of radicals and ions to the substrate (5) ion flux/ion energy determines film properties, and (6) Plasma assisted CVD (PACVD), with particular attention being paid to the characteristics of PACVD. The possible applications in many areas for low friction diamond-like carbon coatings are reviewed. Specific attention is paid to the use of the coatings on engine powertrain components. In conclusion the talk reviews the diamond like carbon coatings properties, and the engine applications. This is presented in view graph format.
CASI
Coating; Deposition; Diamonds; Engine Parts; Vapor Deposition; Diamond Films; Vacuum Deposition

19990070399 Liburdi Engineering Ltd., Dundas, Ontario Canada
ENABLING TECHNOLOGIES FOR TURBINE COMPONENT LIFE EXTENSION
Liburdi, J., Liburdi Engineering Ltd., Canada; March 1999; 7p; In English; See also 19990070390; Copyright Waived; Avail: CASI; A02, Hardcopy; A02, Microfiche

The evolution in materials and turbine design has resulted in the parallel development of advanced equipment and processes capable of manufacturing and repairing the critical engine components. Modern, vision based automated welding systems are now essential for precise , low heat welding of crack sensitive alloy, while unique powder metallurgy process such as LPM-TM allows repairs to be engineered for higher localized strength or better wear properties such as abrasive tips. Significant changes have also occurred in the stripping and coating processes with the introduction of sophisticated vapor based technologies that are beyond reach of smaller repair facilities. The availability and costs associated with these enabling technologies, along with the difficulty in obtaining approvals, will serve to further consolidate the industry and restrict the sources for advanced component repairs.
Author
Engine Parts; Maintenance; Turbines; Welding; Powder Metallurgy; Turbine Blades; Brazing; Coating

19990070400 Orenda Aerospace Corp., Advanced Materials and Energy Systems, Gloucester, Ontario Canada
DEVELOPMENT OF A QUALIFICATION METHODOLOGY FOR ADVANCED GAS TURBINE ENGINE REPAIRS/REWORKS
Patnaik, P. C., Orenda Aerospace Corp., Canada; Thamburaj, R., Orenda Aerospace Corp., Canada; March 1999; 11p; In English; See also 19990070390; Copyright Waived; Avail: CASI; A03, Hardcopy; A02, Microfiche

In this paper the engine and component qualification test requirements with specific application to component repairs/reworks of Civilian and US military specifications and standards for turboshaft, turboprop, turbofan and turbojet engines have been reviewed and a methodology developed. Having identified that repairs were feasible and cost beneficial, a review of civil and military airworthiness guidance was conducted in order to identify a process that would ensure that a high state of airworthiness was maintained and which would easily translate to civil requirements. Failure mode, effects and criticality analysis, as a reliability analysis tool, for Gas Turbines has been developed for component repair/reworks. As part of the development of a FMECA engineering tool, a specific procedure has been developed for performing FMECA on various type of gas turbines, including turbojet, turbofan, turboshaft and turboprop engines. According to the specification established by Orenda and GasTOPS (the sub-contactor), the developed software contains the following: (1) System definition with iconic display, (2) Complete FMEA capable to use either hardware or functional approach or a combination of both, (3) Complete CA capability with either qualitative or quantitative method and, (4) FMECA report format to help the users to generate a complete FMECA report. The software is a generic FMECA tool for the applications to various types of aircraft engine systems, including turbojet, turbofan, turboshaft turboprop and etc. The test of the software has been carried out by both GasTOPS and Orenda using a set of F-404 data. In terms of a Qualification Methodology Development, coupon, component and full scale engine testing are required by all standards to show compliance with the structural integrity and durability requirements (e.g. low cycle fatigue, high cycle fatigue, creep, vibration, containment) for gas path structural components under different environmental operating conditions. An Engine Repair Structural Integrity Program (ERSIP) Standard was proposed which is an integral part of the Qualification Methodology for engine component repairs. The ERSIP Standard incorporates the damage tolerance concept as required in MIL-STD-1783 (USAF-Engine Structural Integrity Program (ENSIP)). The ENSIP Standard establishes the repair development and repair qualification tests to ensure structural integrity and performance throughout the repair life cycle.
Author
Engine Tests; Equipment Specifications; Failure Analysis; Turbojet Engines; Turboprop Engines; Turboshafts; Structural Failure; Maintenance; Life (Durability)

19990070401 Lufthansa Technik A.G., Hamburg, Germany
ADVANCED RECONTOURING PROCESS FOR COMPRESSOR BLADES
Panten, M., Lufthansa Technik A.G., Germany; Hoenen, H., Technische Hochschule, Germany; March 1999; 5p; In English; See also 19990070390; Copyright Waived; Avail: CASI; A01, Hardcopy; A02, Microfiche

This paper deals with the re-contouring of the leading edges contours of compressor airfoils by application of a newly developed method for the profile definition. Lufthansa Technik AG and the Institute of Jet Propulsion and Turbomachinery, Aachen University of technology have developed the Advanced Recontouring Process (ARP) which is an automated inspection and grinding process to produce defined and airflow optimized leading edge profiles with high reproducibility.
Author
Air Flow; Airfoils; Compressor Blades; Contours; Jet Propulsion; Turbomachinery; Leading Edges; Erosion; Forming Techniques

19990070402 Societe Nationale d'Etude et de Construction de Moteurs d'Aviation, CFM56 Product Support, Melun, France
REPAIR DEVELOPMENTS TO FIT CUSTOMER NEEDS
Burlon, Daniel, Societe Nationale d'Etude et de Construction de Moteurs d'Aviation, France; March 1999; 3p; In English; See also 19990070390; Copyright Waived; Avail: CASI; A01, Hardcopy; A02, Microfiche

This presentation describes the repair development process from identification of repair needs to repaired parts installed on an engine. The key factors in this process will be identified and economical inputs will be highlighted. The presentation will show how and why Snecma-services involves customers in identification of repair need and in the evaluation process. This process is called : Top Repair Program.
Author
Aircraft Maintenance; Deterioration; Identifying; Fault Detection; Ground Support Equipment; Shops

19990070403 General Electric Co., Aircraft Engines, Cincinnati, OH USA
FRACTURE MECHANICS EVALUATION OF WELD REPAIRED SEAL TEETH FOR LIFE EXTENSION OF AIRCRAFT GAS TURBINE ENGINE COMPONENTS
Domas, P. A., General Electric Co., USA; March 1999; 8p; In English; See also 19990070390; Copyright Waived; Avail: CASI; A02, Hardcopy; A02, Microfiche

Typical aircraft gas turbine engine rotating air seals incorporate radial protruding, knife-like, circumferential seal teeth at the outer diameter that intrude into a surrounding abradable shroud, forming a seal to unwanted air passage. The thin teeth are susceptible to wear in operation and nicks and dents during assembly and disassembly for overhaul. It is economically desirable to be able to repair such worn or damaged seals for return to service. A potential repair process is to grind down the tip of a damaged tooth, rebuild it with overlaid layers of similar alloy weld metal and machine the built up material back to final shape. A complication is that the weld material may contain porosity or other microstructural features that can act as a surface or subsurface fatigue crack initiation sites and limit the

cyclic life capability of a repaired tooth. This paper discusses an experimental fatigue test program and associated test specimen and component fracture mechanics analyses conducted to assess the viability of a seal tooth weld repair process. The role of simulated component fatigue testing, nondestructive evaluation, fatigue and residual life prediction, and design trade studies in determination of life extension plans is discussed. Complication and issues that arise and potential means of addressing these are emphasized.
Author
Crack Initiation; Engine Parts; Fatigue Tests; Fracture Mechanics; Gas Turbine Engines; Life (Durability); Nondestructive Tests; Seals (Stoppers); Surface Cracks; Wear

19990070405 Defence Evaluation Research Agency, Farnborough, UK
THE DEVELOPMENT OF LIFE EXTENSION METHODS FOR FRACTURE CRITICAL AERO-ENGINE COMPONENTS
Boyd-Lee, A. D., Defence Evaluation Research Agency, UK; Harrison, G. F., Defence Evaluation Research Agency, UK; March 1999; 10p; In English; See also 19990070390; Copyright Waived; Avail: CASI; A02, Hardcopy; A02, Microfiche

Service experience and the rapid advancement of understanding frequently prompt revisions of the declared service lives for aeroengine components. Downward revisions can occur because: 1) ex-service disc tests show that engine operation is harder on components than was estimated at design; 2) in-service cracks, catastrophic failures, and ex-service testing show that some failure mechanisms differ from those identified at design; 3) improvements to service usage models has resulted in more conservative exchange rates; 4) refined analyses for some components show the operating stresses are higher than those estimated at design; and 5) some component design modifications cause a change in a life limiting critical area, etc. From whatever cause, the imposition of service life reductions often results in unexpected component life expires. The resulting costs of grounding the aircraft and of engine removal can be many times greater than the component replacement costs. Thus, demand for life extensions is usually aimed at life reduced parts. Three life extension methods developed to meet this need are presented. Firstly, methods of life extension for crack tolerant component designs are outlined. Secondly, a robust statistical method for exploitation of non-finite results is demonstrated to provide significant life extensions. (A non-finite result is associated with a test stopped before reaching the desired component dysfunction point). Finally, in view of the importance of risk assessment modelling in the more critical cases, the derivation of a risk of fatigue failure model is presented. In this paper, the life-to-first-crack concept and the '2/3 dysfunction' criterion are used as standard 'reference lives' or 'stakes in the ground' relative to which life extensions are measured.
Author
Technology Assessment; Service Life; Failure; Aircraft Engines

19990070406 Motoren- und Turbinen-Union G.m.b.H., Dept. TPMR and TPMM, Munich, Germany
CRITICAL PARTS' LIFE EXTENSION BASED ON FRACTURE MECHANICS
Blueml, Peter, Motoren- und Turbinen-Union G.m.b.H., Germany; Broede, Juergen, Motoren- und Turbinen-Union G.m.b.H., Germany; March 1999; 7p; In English; See also 19990070390; Copyright Waived; Avail: CASI; A02, Hardcopy; A02, Microfiche

The classical method for fracture critical parts lifing is the safe life approach, where 'safe life' in fact means safe crack initiation life. In many cases, the released life of a critical part can be extended if the lifing concept is supplemented with the safe crack propagation life approach. In particular, if the life limiting area of a part possesses substantial damage tolerance capability, the possible parts' life extension will be significant. The underlying safety criteria and the statistical treatment of the test results for both the approaches are equivalent, but for prediction of the crack propagation life the application of fracture mechanics methods and the knowledge of material crack growth behaviour are necessary. Crack growth is directly related to the stress intensity factor. The stress intensity factor itself depends on the currently applied stress field (which in turn depends on mechanical and thermal loading), the geometry of the component, and the current shape of the crack front. Load and crack front shape vary with time. Two methods are discussed how the stress intensity factor can be obtained, namely experimentally from crack growth tests of the real component or analytically from 3D finite element calculations. Service life of an aero engine component is determined by its released life and its life consumption caused by operational usage. Therefore, it is important to monitor the operational usage either by on-board monitoring devices or by the application of adequate cyclic exchange rates (r-factors). Experience gained with the RB199 IP compressor and IP turbine (where this safe crack propagation life approach is utilized) shows that crack propagation -factors are by a factor of 2 - 3 higher than crack initiation ,B-factors. Nevertheless, the achieved life extension in terms of engine flying hours is about 40%.
Author
Rates (Per Time); Tolerances (Mechanics); Aircraft Engines; Life (Durability); Fracture Mechanics; Service Life

19990070407 NASA Lewis Research Center, Cleveland, OH USA
DAMAGE TOLERANCE AND RELIABILITY OF TURBINE ENGINE COMPONENTS
Chamis, Christos C., NASA Lewis Research Center, USA; March 1999; 13p; In English; See also 19990070390; Copyright Waived; Avail: CASI; A03, Hardcopy; A02, Microfiche

A formal method is described to quantify structural damage tolerance and reliability in the presence of multitude of uncertainties in turbine engine components. The method is based at the materials behaviour level where primitive variables with their respective scatters are used to describe the behavior. Computational simulation is then used to propagate those uncertainties to the structural scale where damage tolerance and reliability are usually specified. Several sample cases are described to illustrate the effectiveness, versatility, and maturity of the method. Typical results from these methods demonstrate that the methods are mature and that they can be used for future strategic projections and planning to assure better, cheaper, faster, products for competitive advantages in world markets. These results also indicate that the methods are suitable for predicting remaining life in aging or deteriorating structures.
Author
Damage; Deterioration; Engine Parts; Management Planning; Predictions; Reliability; Turbine Engines; Aircraft Maintenance; Simulation; Failure Modes; Structural Analysis; Probability Theory; Damage Assessment

19990070408 Technical Univ. of Lisbon, Portugal
LIFE EXTENSION METHODOLOGY BASED ON CREEP-FATIGUE MODELS
Branco, C. Moura, Technical Univ. of Lisbon, Portugal; SousaeBrito, A., Technical Univ. of Lisbon, Portugal; Byrne, J., Portsmouth Univ., UK; March 1999; 19p; In English; See also 19990070390
Contract(s)/Grant(s): AGARD Proj. P111; Proj. CCI Defesa 07/91; Copyright Waived; Avail: CASI; A03, Hardcopy; A02, Microfiche

The first part of this paper presents the results of a detailed study carried out in the nickel base superalloy IN718 used in turbine discs where fatigue and creep crack growth rate data (FCGR and CCGR) was obtained at 600C in CT and CC specimens tested at different values of stress ration and dwell time at maximum load (frequency). In the second part of the paper a presentation is made of creep-fatigue models and also the results obtained with a computer program developed by the authors, which is able to make a comparison between the experimental data obtained for the FCGR in creep-fatigue situation and the equivalent results predicted by the models. This methodology can be directly used, with great advantages, in predictions of life extension in flawed components.
Author
Computer Programs; Crack Propagation; Creep Properties; Heat Resistant Alloys; Nickel Alloys; Turbines; Disks; Cracking (Fracturing); Fatigue (Materials); Mathematical Models; Aircraft Maintenance

19990102970 Research and Technology Organization, Applied Vehicle Technology Panel, Neuilly-sur-Seine, France
PLANAR OPTICAL MEASUREMENT METHODS FOR GAS TURBINE COMPONENTS *[METHODES DE MESURE OPTIQUES PLANAIRES POUR ORGANES DE TURBOMOTEURS]*
September 1999; 148p; In English; 16-17 Sep. 1999; 21-22 Sep. 1999, Cranfield, Cleveland, OH, UK, USA; See also 19990102971 through 19990102977; Original contains color illustrations
Report No.(s): RTO-EN-6; AC/323(AVT)TP/20; ISBN 92-837-1019-

3; Copyright Waived; Avail: CASI; A07, Hardcopy; A02, Microfiche; US Distribution and Sales Only

This lecture series covers the recent advances of planar optical measurement techniques with respect to their applicability to gas turbine component tests. During the last years much progress has been achieved in various known techniques, and new methods have been developed from which a significant increase of the experimental output of propulsion tests and therefore remarkable cost reduction can be expected. To bring this status into the knowledge of the propulsion specialists is the aim of this lecture series.Its theme is focused on laser measurement methods for the analysis of the internal flow and reaction processes in propulsion engines. It will address techniques for the measurement of flow velocity, flow density, pressure, temperature and species concentration. Only those methods are introduced which are far enough developed to be applicable to the rough test conditions of propulsion experiments. The course will inform the audience about the fundamentals of the advanced measurement techniques, as well as demonstrate their use in the context of practical applications. The material in this publication was collected from the research centers of the different NATO nations. It will transfer to the propulsion engineers in a condensed manner the information of the newest capabilities of modern test techniques thus providing the knowledge base for tomorrow's measurement instrumentation of propulsion test facilities. NATO's specific interest in sponsoring this event is based on the requirement for engines of extreme performance characteristics which cannot be realised without further improvements of both CFD and measurement technologies.

Author

Conferences; Flow Measurement; Flow Velocity; Gas Turbine Engines; Optical Measurement

19990102971 Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Inst. of Propulsion Technology, Cologne, Germany

CAPABILITIES OF OPTICAL POINT MEASUREMENT TECHNIQUES WITH RESPECT TO AERO ENGINE APPLICATION

Schodl, R., Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; Planar Optical Measurement Methods for Gas Turbine Components; September 1999, pp. 1-1 - 1-15; In English; See also 19990102970; Original contains color illustrations; Copyright Waived; Avail: CASI; A03, Hardcopy; A02, Microfiche; US Distribution and Sales Only

Concerning the further development of gas turbine engines advances of the aero-thermodynamic design can he achieved most efficiently by co-operative efforts aimed at the improvement of both the numerical simulation methods and the experimental test and measurement techniques. Rapid development ot numerical capability is accompanied with increasing demands on experimental data. In this context significant instrumentation research efforts are being conducted to develop the needed mea.surement technologies. In this paper an overview about the current capabilities of point measurement techniques as LDA, PDA, L2F, CARS under turbomachinery test conditions is pre.sented. Three component laser velocimetry is treated to a great extend pointing out both examples of successful measurements with detailed flow information and in which way application related problems were solved. Examples of successful applications of CARS thermometry to jet engine combustors are also given together with an estimation of its application limits. The paper concludes with an evaluation of the power ot point measurement techniques in comparison to planar techniques

Author

Laser Anemometers; Laser Doppler Velocimeters; Optical Measurement; Temperature Measurement; Gas Turbine Engines; Jet Engines; Procedures

19990102972 NASA Glenn Research Center, Cleveland, OH USA

APPLICATION OF DIGITAL PARTICLE IMAGING VELOCIMETRY TO TURBOMACHINERY

Wernet, Mark P., NASA Glenn Research Center, USA; Planar Optical Measurement Methods for Gas Turbine Components; September 1999, pp. 2-1 - 2-33; In English; See also 19990102970; Original contains color illustrations; Copyright Waived; Avail: CASI; A03, Hardcopy; A02, Microfiche; US Distribution and Sales Only

Digital Particle Imaging Velocimetry (DPIV) is a powerful measurement technique, which can be used as an alternative or complementary approach to Laser Doppler Velocimetry (LDV) in a wide range of research applications. The instantaneous planar velocity measurements obtained with PIV make it an attractive technique for use in the study of the complex flow fields encountered in turbomachinery. Many of the same issues encountered in the application of LDV to rotating machinery apply in the application of PIV. Techniques for optical access, light sheet delivery, CCD camera technology and particulate seeding are discussed. Results from the successful application of the PIV technique to both the blade passage region of a transonic axial compressor and the diffuser region of a high speed centrifugal compressor are presented. Both instantaneous and time-averaged flow fields were obtained. The 95% confidence intervals for the time-averaged velocity estimates were also determined. Results from the use of PIV to study surge in a centrifugal compressor are discussed. In addition, combined correlation/particle tracking results yielding super-resolution velocity measurements are presented.

Author

Correlation Detection; Particle Image Velocimetry; Velocity Measurement; Turbomachinery; Transonic Compressors; Procedures

19990102974 Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Inst. of Propulsion Technology, Cologne, Germany

PLANAR QUANTITATIVE SCATTERING TECHNIQUES FOR THE ANALYSIS OF MIXING PROCESSES, SHOCK WAVE STRUCTURES AND FLUID DENSITY

Schodl, R., Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; Planar Optical Measurement Methods for Gas Turbine Components; September 1999, pp. 3-1 - 3-15; In English; See also 19990102970; Copyright Waived; Avail: CASI; A03, Hardcopy; A02, Microfiche; US Distribution and Sales Only

Quantitative Visualization Techniques (QVT) considered in this contribution are planar measurement techniques which make use of laser light sheet and CCD-camera and deliver quantitative information of flow properties. The elastic scattering of laser light either on seeding particles or molecules is used for the measurement. Three different methods are treated: The Quantitative Light Sheet (QLS) technique for mass-fraction measurement of mixing processes, The Tracer based Shock Visualization (TSV) for the measurement of shape and structure of compression shocks and UV-Rayleigh Scattering density measurements for flow Results of measurements in a model combustor, in a transonic compressor and in a turbine cascade are presented and discussed.

Author

Procedures; Flow Characteristics; Density Measurement; Elastic Scattering

20000020789 Research and Technology Organization, Applied Vehicle Technology Panel, Neuilly-sur-Seine, France

DESIGN PRINCIPLES AND METHODS FOR AIRCRAFT GAS TURBINE ENGINES *[LES PRINCIPES ET METHODES DE CONCEPTION DES TURBOMOTEURS]*

Design Principles and Methods for Aircraft Gas Turbine Engines; February 1999; 482p; In English; In French; 11-15 May 1998, Toulouse, France; See also 20000020790 through 20000020828; Original contains color illustrations

Report No.(s): RTO-MP-8; AC/323(AVT)TP/9; ISBN 92-837-0005-8; Copyright Waived; Avail: CASI; A21, Hardcopy; A04, Microfiche

The symposium dealt with design approaches for military aircraft propulsion systems to provide enhanced operational flexibility, longer range, better fuel efficiency and improved affordability. All classes of gas turbines were addressed in nine sessions as follows: Engine Design and Analysis (Part 1) (5 papers); Mechanical Systems (6 papers) Controls (4 papers); Combustors/Augmentors (4 papers); Compressor Systems (Part 1) (5 papers); Compressor Systems (Part 2) (3 papers); Turbines (Part 1) (5 papers); Turbines (Part 2) (4 papers); and Engine Design and Analysis (Part 2) (4 papers). These proceedings also include a Technical Evaluation Report and a Keynote address published in French and English.

Derived from text

Aircraft Engines; Gas Turbine Engines; Engine Parts; Conferences; Engine Design

20000020790 Air Force Research Lab., Propulsion Directorate, Wright-Patterson AFB, OH USA

THE GAS TURBINE ENGINE CONCEPTUAL DESIGN PROCESS: AN INTEGRATED APPROACH

Stricker, Jeffrey M., Air Force Research Lab., USA; Design Principles

and Methods for Aircraft Gas Turbine Engines; February 1999, pp. 1-1 - 1-9; In English; See also 20000020789; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

The conceptual design process of gas turbine engines is complex, involving many engineering disciplines. Aerodynamics, thermodynamics, heat transfer, materials science, component design, and structural analysis are a few of the fields employed when down selecting an appropriate engine configuration. Because of the complexity involved, it is critical to have a process that narrows engine options without missing the 'optimum'. The following paper describes a typical process used at the conceptual design level. The various steps that will be described include propulsion requirements definition, engine cycle analysis, component design, flowpath/weight prediction, installation, and engine design influence on aircraft size and performance. The engine design process is not completely linear since the steps listed above are highly interdependent. A number of iterations are usually necessary in selecting a final engine configuration. This paper will describe several of the inter-relationships between the various steps. Frequently, a particular aircraft system has special requirements that influence the design selection process. Some modem day examples of these criteria include reduced observables and cost reduction. How these variations arc incorporated into the conceptual design process will be discussed.
Derived from text

Engine Design; Gas Turbine Engines; Structural Analysis; Thermodynamics; Weight Analysis

20000020791 Motoren- und Turbinen-Union G.m.b.H., Munich, Germany
DESIGN OF A NEW FIGHTER ENGINE: THE DREAM IN AN ENGINE MAN'S LIFE

Schaeffler, A., Motoren- und Turbinen-Union G.m.b.H., Germany; Lauer, W., Motoren- und Turbinen-Union G.m.b.H., Germany; Design Principles and Methods for Aircraft Gas Turbine Engines; February 1999, pp. 2-1 - 2-7; In English; See also 20000020789; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

In 1984-85 a feasibility study between 5 European Nations France, Germany, Italy, Spain and UK for a common air superiority fighter was pursued which ended in 4 Nations to step into the Definition Phase in autumn 85. For us this was the beginning of an exciting experience in various roles as MTU Chief Engineers and Technical Directors of Eurojet Turbo GmbH, i.e. Chairmen of the Chief Engineers' meeting. Designing a brand new fighter engine at the very edge of technology is an occasion so seldom that given the opportunity to take a lead function in such a multi-billion dollar project is a dream, which only few enjoy once a life.
Derived from text

Fighter Aircraft; Aircraft Engines; Design

20000020792 Rolls-Royce Ltd., Military Aero Engines, Bristol, UK
DESIGNING FOR RELIABILITY: THE ROLLS-ROYCE APPROACH

Hopper, P. J., Rolls-Royce Ltd., UK; Design Principles and Methods for Aircraft Gas Turbine Engines; February 1999, pp. 3-1 - 3-5; In English; See also 20000020789; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

In today's highly competitive world market, where safety, reliability and operating costs of equipment are often paramount, there are many drivers to maintaining a viable, and economic operation. This is as true in the world of-aerospace as in any other. Aircraft on the ground neither win wars for armed forces nor earn revenue for civil operators. It is against this background that the Rolls-Royce Aerospace Group has as one of its primary objectives the 'provision of reliable, and safe products and services which meet the expectations and specified requirements' of its various customers. These include both military and civil operators, and various regulatory authorities. The task of the Company is therefore to realise the challenge in meeting these safety and reliability requirements in both the civil and military markets at the entry into service of its projects.
Derived from text

Reliability; Operating Costs; Economics; Market Research

20000020793 Pratt and Whitney Aircraft of Canada Ltd., Longueuil, Quebec Canada
THE PW100 ENGINE: 20 YEARS OF GAS TURBINE TECHNOLOGY EVOLUTION

Hosking, E., Pratt and Whitney Aircraft of Canada Ltd., Canada; Kenny, D. P., Pratt and Whitney Aircraft of Canada Ltd., Canada; McCormick, R. I., Pratt and Whitney Aircraft of Canada Ltd., Canada; Moustapha, S. H., Pratt and Whitney Aircraft of Canada Ltd., Canada; Sampath, P., Pratt and Whitney Aircraft of Canada Ltd., Canada; Smailys, A. A., Pratt and Whitney Aircraft of Canada Ltd., Canada; Design Principles and Methods for Aircraft Gas Turbine Engines; February 1999, pp. 4-1 - 4-9; In English; See also 20000020789; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

The PW100 three-spool turboprop engine family has been designed for the commuter, utility and executive aircraft markets. The first PW 100 engine, with a thermal power rating of 1780 Kw, entered service in the mid-1980s. Growth through increased pressure ratio and turbine inlet temperature as well as application of new technology has allowed the power of the engine to reach 4980 Kw for the latest PW150. This paper will highlight examples of this technical evolution covering the cold and hot end, gearbox, installation and control systems and the application of the latest three-dimensional aerodynamic and stress analysis to the design of the different components.
Derived from text

Gas Turbines; Turboprop Engines; Stress Analysis

20000020794 Daimler-Benz Aerospace A.G., Munich, Germany
PROCESS OPTIMIZATION IN ADVANCED COMPRESSOR DESIGN

Schulze, Gisbert, Motoren- und Turbinen-Union G.m.b.H., Germany; Geidel, Helmut A., Motoren- und Turbinen-Union G.m.b.H., Germany; Pirker, Klaus, Motoren- und Turbinen-Union G.m.b.H., Germany; Design Principles and Methods for Aircraft Gas Turbine Engines; February 1999, pp. 6-1 - 6-8; In English; See also 20000020789; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

After an overview of MTU's current compressor projects, this paper focuses towards the fundamentals of the team oriented integrated product design process(IPD) and a new approach to its goals, the advanced multi-disciplinary design process. The new idea behind this process is the focus on the integration of the most important design skills in one person. Most of the compressor design work is performed by the same person with the support of a team of specialists of the different disciplines rather than carrying out the different tasks by different members of the team. The goal of this process is a further reduction in development lead time and cost and a better focus on project requirements rather than on certain discipline requirements.
Author

Compressors; Costs; Design; Optimization; Design To Cost; Design Analysis

20000020795 Fiat Aviazione S.p.A., Direzione Tecnica, Turin, Italy
ACTUATION SYSTEM FOR VARIABLE EXHAUST NOZZLE AND INLET GUIDE VANES ON AN ADVANCED GAS TURBINE ENGINE

Bardone, G., Fiat Aviazione S.p.A., Italy; Marchetti, S., Fiat Aviazione S.p.A., Italy; Trovati, A., Fiat Aviazione S.p.A., Italy; Design Principles and Methods for Aircraft Gas Turbine Engines; February 1999, pp. 7-1 - 7-17; In English; See also 20000020789; Copyright Waived; Avail: CASI; A03, Hardcopy; A04, Microfiche

Aircraft engines with afterburner need to have variable exhaust nozzle and inlet guide vanes in order to control the air flow. Different types of actuation systems provide the force to move such variable geometry devices. The paper describes the architecture of a hydraulic actuation system installed on a military engine of the last generation, paying particular attention to the technical solutions chosen to keep at minimum mass and heat re.jection and to the dynamic mathematical model used during the development to predict the nozzle area behaviour, inlet guide vanes position, hydraulic oil flows and pressures as functions of external loads, engine rating and commanded positions.
Author

Actuators; Exhaust Nozzles; Intake Systems; Guide Vanes; Gas Turbine Engines; Afterburning

20000020796 Turbomeca S.A. - Brevets Szydlowski, Bordes, France
THE RELIABILITY OF AERONAUTICAL BEARINGS AND THEIR BEHAVIOR IN FATIGUE ***[LA FIABILITE DES ROULEMENTS AERONAUTIQUES ET LE COMPORTEMENT EN FATIGUE]***
Cheftel, Brigitte, Turbomeca S.A. - Brevets Szydlowski, France; Paty, Gerard, Turbomeca S.A. - Brevets Szydlowski, France; Design Principles and Methods for Aircraft Gas Turbine Engines; February 1999, pp. 8-1 - 8-6; In French; See also 20000020789
Contract(s)/Grant(s): BRE2-CT92-0209; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

Gas turbine bearings are mechanical components which influence engine performance through this reliability. They link rotating parts to stationary ones. A bearing failure may have serious consequences such as engine out of order or aeroship maneuverability losses. Engine improvements through SFC and weight/power ratio lead to increase rotational speeds and other parameters such as applied loads and bulk temperature. As other engine manufacturers, TURBOMECA use to design bearings such to prevent typical failures observed on field. The fatigue defect is the most important to be addressed. In this context, it has been raised that an endurance limit under which no fatigue is developed exists. A research programme named 'ELABOMM' involving bearings and turbine engines Manufacturers and University and funded by the CEC was conducted during four years in order to identify the influencing parameters and the threshold of this endurance limit in dependence of their value. It resulted a model and a databank available at the en 'gine manufacturer offices which can be used to design bearings with confidence relatively to the expected fatigue behaviour.
Author
Reliability; Gas Turbines; Turbine Engines; Bearings; Failure; Fatigue (Materials)

20000020797 Air Force Research Lab., Propulsion Directorate, Wright-Patterson AFB, OH USA
COMPUTER MODELING OF HEAT GENERATION IN VAPOR LUBRICATED BEARINGS FOR GAS TURBINES
Forster, Nelson H., Air Force Research Lab., USA; Givan, Garry D., Air Force Research Lab., USA; Design Principles and Methods for Aircraft Gas Turbine Engines; February 1999, pp. 9-1 - 9-10; In English; See also 20000020789; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

Analytical and experimental data are presented for a 30 mm bore ball bearing operating at 31,000 rpm (0.93 MDN where MDN=l0 (exp -6) x shaft diameter x shaft rpm), applied thrust load of 445 N (1.0 GPa maximum Hertzian contact stress), and a steady-state bulk outer race temperature of 425 C (135 C above the initial static temperature of 290 C). The bearing was lubricated with a tertiary-butyl phenyl phosphate (TBPP) delivered from the vapor phase at 325 C. The steady-state bearing torque, at the conditions described above, was 0.07 N-m, resulting in a bearing power loss of 227 W. The major advantage of vapor lubrication in gas turbines is the potential to eliminate the conventional liquid lubrication system, resulting in considerable weight and cost savings benefits. The major disadvantage of vapor lubrication, is the inability to remove the bearing heat generation due to loss of the recirculating liquid lubricant. Although heat transfer poses potential problems, the higher temperature capability of the TBPP vapor lubricant, 600 C compared to 200 C for a recirculating polyester liquid lubricant, may enable the vapor lubricant to withstand this higher heat generation. This paper takes a first look at examining heat generation in vapor lubricated bearings. To accomplish this, friction measurements were made in a single bearing contact under controlled conditions of rolling and sliding. Tile lubricant was delivered as vapor to the bearing contact. Friction measurements were made at ball temperatures of 300 C and 400 C; stress loads of 0.75 GPa, 1.00 GPa, 1.25 GPa, and 1.50 GPa; and rolling speeds of 10 m/s and 15 m/s. Using the friction measurement as input data, analysis of the bearing was performed at the experimental test conditions using the bearing computer program ADORE. After validating the computer model to match the experimental bearing heat generation, parametric computer runs were made for the bearing geometry operating at conditions of 1.0 MDN to 2.0 MDN, and applied contact loads of 1.0 GPa and 2.0 GPa. Under the most severe case, 2.0 MDN and 2.0 GPa of contact stress, the 30 mm bore test bearing is expected to generate 3742 watts of heat. Additional analysis is required to convert this heat input to the expected operational bearing temperature, but the results suggest that improved heat transfer will be required to meet the conditions at 2.0 MDN and 2.0 GPa of Hertzian contact stress.
Author
Computerized Simulation; Vapor Phases; Lubrication Systems; Lubricants; Heat Generation; Ball Bearings

20000020798 NASA Lewis Research Center, Cleveland, OH USA
ADVANCED SEAL TECHNOLOGY ROLE IN MEETING NEXT GENERATION TURBINE ENGINE GOALS
Steinetz, Bruce M., NASA Lewis Research Center, USA; Hendricks, Robert C., NASA Lewis Research Center, USA; Munson, John, Allison Engine Co., USA; Design Principles and Methods for Aircraft Gas Turbine Engines; February 1999, pp. 11-1 - 11-13; In English; See also 20000020789; Original contains color illustrations; Copyright Waived; Avail: CASI; A03, Hardcopy; A04, Microfiche

Cycle studies have shown the benefits of increasing engine pressure ratios and cycle temperatures to decrease engine weight and improve performance in next generation turbine engines. Advanced seals have been identified as critical in meeting engine goals for specific fuel consumption, thrust-to-weight, emissions, durability and operating costs. NASA and the industry are identifying and developing engine and sealing technologies that will result in dramatic improvements and address the goals for engines entering service in the 2005-2007 time frame. This paper provides an overview of advanced seal technology requirements and highlights the results of a preliminary design effort to implement advanced seals into a regional aircraft turbine engine. This study examines in great detail the benefits of applying advanced seals in the high pressure turbine region of the engine. Low leakage film-riding seals can cut in half the estimated 4% cycle air currently used to purge the high pressure turbine cavities. These savings can be applied in one of several ways. Holding rotor inlet temperature (RIT) constant the engine specific fuel consumption can be reduced 0.9%, or thrust could be increased 2.5%, or mission fuel burn could be reduced 1.3%. Alternatively, RIT could be lowered 20 'F resulting in a 50% increase in turbine blade life reducing overall regional aircraft maintenance and fuel bum direct operating costs by nearly 1%. Thermal, structural, secondary-air systems, safety (seal failure and effect), and emissions analyses have shown the proposed design is feasible.
Author
Sealing; Aircraft Engines; Turbine Engines; Pressure Ratio; Gas Turbine Engines

20000020799 Motoren- und Turbinen-Union G.m.b.H., Munich, Germany
FUEL/OIL SYSTEM THERMAL MANAGEMENT IN AIRCRAFT TURBINE ENGINES
Streifinger, Helmut, Motoren- und Turbinen-Union G.m.b.H., Germany; Design Principles and Methods for Aircraft Gas Turbine Engines; February 1999, pp. 12-1 - 12-10; In English; See also 20000020789; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

The fuel consumed by an aircraft turbine engine is the preferred heat sink for its lubrication, hydraulic, and integrated drive generator oil systems. Reasons for this are, that a fuel/oil heat exchanger is more compact, if compared with an air/oil cooler, and causes no drag increase and no engine performance loss from air bleed or loss of momentum of the air. Furthermore, the energy exchanged in the fuel/oil cooler is conserved in the thermodynamic cycle. ne capacity of the fuel as a heat sink is temperature limited, however, and the fuel pumps contribute to the fuel heating as well. Integration of the fuel and oil systems to a thermal management system is required, which performs its functions without exceeding fuel or oil temperature limits within the aircraft flight envelope. To make this possible, reduction of the oil system heat rejection, as well as the installation of air/oil heat exchangers, has to be considered early in the engine development programme (Ref. 1). A continuous analysis of the heat loads from fuel and oil systems is required, until sufficient test evidence proves that the design meets the requirements.
Derived from text
Management Systems; Fuel Oils; Thermodynamic Cycles; Turbine Engines; Aircraft Engines; Systems Management

20000020800 Rolls-Royce Ltd., Military Aero Engines, Bristol, UK
FAULT TOLERANT DESIGN METHODOLOGY IN SOFTWARE FOR SAFETY RELATED SYSTEMS
Cockram, Trevor, Rolls-Royce Ltd., UK; Design Principles and Methods for Aircraft Gas Turbine Engines; February 1999, pp. 13-1 - 13-6; In English; See also 20000020789
Contract(s)/Grant(s): DTI Project IED4/1/9004; Avail: CASI; A02, Hardcopy; A04, Microfiche

System failures caused by software are not caused by wear out; they are due to errors in the design or specification of the software. Most activities during the software development process have the potential to cause errors in the final software code. An important mechanism in this type of systematic error is human error, both as individuals and within groups. Adherence to procedures or standards implies a kind of fault tolerant design. However, in order to judge whether practices are effective at achieving the required integrity of the product, a measurement based approach to software design is required. The methodology described has been developed to provide project managers with a means to assess the integrity of the software product at any stage prior to delivery. The product integrity is described in terms of the probability distribution for the numbers of errors that exist in any product or set of products. The approach is equally applicable to determine the effectiveness of the quality assurance processes and of any error correction mechanism including software maintenance. The methodology is supported by a tool that uses graphical probability models to describe each atomic development or review process, defining the dependencies between the process attributes. Bayesian statistics are then used to calculate the integrity prediction using a priori experience together with evidence.
Author
Systematic Errors; System Failures; Quality Control; Procedures; Fault Tolerance; Error Analysis

20000020801 Technical Univ. of Munich, Lehrstuhl fuer Flugantriebe, Muchen, Germany
MONITORING AND CONTROL OF HELICOPTER ENGINES AT ABNORMAL OPERATING CONDITIONS
Erhard, W., Technical Univ. of Munich, Germany; Gabler, R., Technical Univ. of Munich, Germany; Preiss, A., Technical Univ. of Munich, Germany; Rick, H., Technical Univ. of Munich, Germany; Design Principles and Methods for Aircraft Gas Turbine Engines; February 1999, pp. 14-1 - 14-10; In English; See also 20000020789; Avail: CASI; A02, Hardcopy; A04, Microfiche

A digital non-flight standard control system for the helicopter engine ALLISON 250-C20B has been developed. It is used as a development slave system at the institute's test bed for various research projects. The topics to be presented in this paper cover control and monitoring aspects for these types of engines in the presence of abnormal operating conditions. Investigated are compressor rotating stall and surge due to engine failure, control system failure, inlet distortion, as well as water ingestion problems. To get control over the operating line of the engine and to avoid, respectively to abort a surge condition an appropriate bleed valve can be used. Therefore the original valve is replaced by a newly developed simple and cost effective one which is integrated into the electronic control system and can be controlled by software. The software itself is developed with means of an object oriented tool and runs on a rapid prototyping real-time computer. To detect stall and surge onset as early as possible different methods of signal analysis are applied and investigated. The wavelet method as a relatively new one proved to be very interesting for such applications. But it emerged that in many cases, particularly at slam accelerations, it was not possible to avoid surge entirely with the developed system, because of insufficient actuator dynamics. Therefore a special control mode was developed to abort surge immediately and recover to normal operation.
Author
Helicopter Engines; Electronic Control; Wavelet Analysis; System Failures; Real Time Operation; Engine Failure; Abnormalities

20000020802 Purdue Univ., School of Mechanical Engineering, West Lafayette, IN USA
SIMULTANEOUS ACTIVE SOURCE CONTROL OF BLADE ROW INTERACTION GENERATED DISCRETE TONES
Sawyer, Scott, Purdue Univ., USA; Fleeter, Sanford, Purdue Univ., USA; Design Principles and Methods for Aircraft Gas Turbine Engines; February 1999, pp. 15-1 - 15-11; In English; See also 20000020789; Avail: CASI; A03, Hardcopy; A04, Microfiche

Unsteady blade row interactions in turbomachines generate discrete-frequency tones at blade pass frequency and its harmonics. Specific circumferential acoustic modes are generated. However, only certain of these modes propagate upstream and downstream to the far field, with these the discrete frequency noise received by an observer. This paper is directed at experimentally demonstrating the viability of active noise control utilizing active airfoils to generate propagating spatial modes that interact with and simultaneously cancel the upstream and downstream propagating acoustic modes. This is accomplished by means of fundamental experiments performed in the Purdue Annular Cascade Research Facility configured with 16 rotor blades and 18 stator vanes. At blade pass frequency, only the k(sub 0) = -2 spatial mode propagates. Significant simultaneous noise reductions are achieved for these upstream and downstream propagating spatial modes over a wide range of operating conditions.
Author
Active Control; Airfoils; Noise Reduction; Turbomachinery; Rotor Blades (Turbomachinery)

20000020803 Naval Air Warfare Center, Propulsion Fuel Systems, Controls and Diagnostics, Patuxent River, MD USA
IMPROVED GAS TURBINE RESPONSE USING LQR CONTROL
Richman, Mike, Naval Air Warfare Center, USA; Gordon, Vernon, Naval Air Warfare Center, USA; Design Principles and Methods for Aircraft Gas Turbine Engines; February 1999, pp. 16-1 - 16-9; In English; See also 20000020789; Avail: CASI; A02, Hardcopy; A04, Microfiche

This paper develops a design methodology for a full state feedback controller using linear quadratic regulator (LQR) multivariable control techniques. The result is a controller that will perform with the quickest settle time, containing optimal stability margin while minimizing the feedback gains to realistic real world values. A correlation will be established between the weighting parameters used in a typical LQR design and their effect on steady state settle time and maximum feedback gain. The entire investigation uses MATLAB with Simulink, including an assortment of control system toolboxes, to design, trend, and evaluate the System with and without the full state feedback controller. A Simulink block diagram was used to design and test a full-state feedback controller. Settle time, maximum feedback gain, and steadystate values were plotted as a function of LQR design parameters Q and R. These parameters weight either the state or control energy for optimization. Choosing a Q identity matrix of 10 and R identity matrix of 0.1 the system was evaluated with both a step input and a sine wave input. The controlled system reduced the steady state settle time by .5 seconds over the open loop step response.
Author
Gas Turbines; Stability; Multivariable Control; Feedback; Design Analysis; Control Systems Design

20000020804 Virginia Polytechnic Inst. and State Univ., Mechanical Engineering Dept., Blacksburg, VA USA
UNSTEADY, FINITE-RATE MODEL FOR APPLICATION IN THE DESIGN OF COMPLETE GAS-TURBINE COMBUSTOR CONFIGURATIONS
Rodriguez, Carlos G., Virginia Polytechnic Inst. and State Univ., USA; OBrien, Walter F., Virginia Polytechnic Inst. and State Univ., USA; Design Principles and Methods for Aircraft Gas Turbine Engines; February 1999, pp. 17-1 - 17-11; In English; See also 20000020789; Avail: CASI; A03, Hardcopy; A04, Microfiche

Design methods for gas-turbine engine combustors require mathematical models that satisfy two simultaneous and often conflicting requirements: to provide an accurate description of the highly complex geometry and physics involved, and be sufficiently inexpensive in computational requirements as to allow its incorporation in a design cycle involving the evaluation of a great number of operating conditions. For these reasons a one-dimensional, finite-rate, unsteady combustor model has been developed that incorporates most elements found in modem gas-turbine burners, and yet is simple enough to be implemented in desktop computers. The model includes the division of the flowpath into annular and primary streams, finite-rate effects within the primary flow, and interaction between hot

and cold gases though dilution holes. Examples show predictions of flow distribution within complete burner configurations, blowout predictions, and the effects of perturbations in boundary and operating conditions.
Author
Unsteady State; Combustion Chambers; Gas Turbine Engines; Mathematical Models

20000020805 Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Inst. for Propulsion Technology, Cologne, Germany
DESIGN PRINCIPLES FOR THE QUENCH ZONE OF RICH-QUENCH-LEAN COMBUSTORS
Hassa, C., Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; Migueis, C. E., Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; Voigt, P., Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; Design Principles and Methods for Aircraft Gas Turbine Engines; February 1999, pp. 18-1 - 18-11; In English; See also 20000020789; Copyright Waived; Avail: CASI; A03, Hardcopy; A04, Microfiche

Isothermal experiments on the mixing of jet rows in crossflow with particular attention to the quench zone mixing of RQL combustor have been carried out. Comparing mixing with combusting and isothermal mixing, it could be demonstrated, that with the combination of jet air concentration measurements and numerical calculations of the flow, medium pressure combustion tests with 3-D probe measurements can be bypassed for the jet row optimization. The study with homogenuous crossflow for RQL combustors without cooling air in the primary zone showed optimum mixing with two staggered rows with close axial spacing. The light sheet technique could be demonstrated to give good quantitative results with higher spatial resolution than any other competing technique if applied with the appropriate care. Its application clearly revealed the influence of swirling, recirculating primary zone flow on the jet mixing.
Author
Design Analysis; Combustion Chambers; Fluid Jets; Jet Mixing Flow; Swirling

20000020806 Fiat Aviazione S.p.A., Direzione Tecnica, Turin, Italy
AFTERBURNER DESIGN AND DEVELOPMENT
Trovati, A., Fiat Aviazione S.p.A., Italy; Turrini, F., Fiat Aviazione S.p.A., Italy; Vinci, C., Fiat Aviazione S.p.A., Italy; Design Principles and Methods for Aircraft Gas Turbine Engines; February 1999, pp. 19-1 - 19-24; In English; See also 20000020789; Original contains color illustrations; Copyright Waived; Avail: CASI; A03, Hardcopy; A04, Microfiche

The paper deals with the design and the development of the afterburner system for an advanced fighter aircraft. The design background of the system and its major components is given, in front of design requirements. The design process is described, Outlining most important design tools, with particular attention to CFD and aerothermal modelling. The principal experimental evidences are also presented. showing the most significant achievements of system development and giving a survey of major problems and relevant solutions during the system development and optimisation process.
Author
Afterburning; Design Analysis; Manufacturing

20000020807 Motoren- und Turbinen-Union G.m.b.H., Engine System Simulation TPSZ, Munich, Germany
A MIXED FLOW TURBOFAN AFTERBURNER SIMULATION FOR THE DEFINITION OF REHEAT FUEL CONTROL LAWS
Kurzke, Joachim, Motoren- und Turbinen-Union G.m.b.H., Germany; Riegler, Claus, Deutsches Zentrum fuer Luft- und Raumfahrt e.V., Germany; Design Principles and Methods for Aircraft Gas Turbine Engines; February 1999, pp. 20-1 - 20-12; In English; See also 20000020789; Copyright Waived; Avail: CASI; A03, Hardcopy; A04, Microfiche

The afterburner fuel flow control for mixed flow turbofan engines is a complex task. At a given nozzle area, burning too much afterburner fuel can throttle the fan until it surges. On the contrary - when not enough heat is released - the fan pressure ratio will decrease and the gas velocity in the jet pipe will rise with the dan;er of blowing out the flame. Ideally, the operating point of the fan in its map should not be affected by the afterburner operation. Two different methods are in use to achieve this at least approximately. In some engines the afterburner fuel flow is controlled 'closed loop' so that a prescribed fan pressure ratio is achieved. The problem with this approach is that in case of an unexpected afterburner ignition delay the nozzle will close with the aim to keep the fan pressure ratio at the target level. When the afterburner fuel ignites in such a situation unexpectedly the nozzle probably cannot open quickly enough and therefore the pressure in the afterburner will rise sharply. This can result in a fan surge.
Derived from text
Turbofans; Afterburning; Simulation; Control Theory; Fuel Control; Multiphase Flow

20000020808 NASA Lewis Research Center, Cleveland, OH USA
NUMERICAL SIMULATION OF MULTI-STAGE TURBOMACHINERY FLOWS
Adamczyk, John J., NASA Lewis Research Center, USA; Hathaway, Michael D., NASA Lewis Research Center, USA; Shabbir, Aamir, NASA Lewis Research Center, USA; Wellborn, Steven R., NASA Lewis Research Center, USA; Design Principles and Methods for Aircraft Gas Turbine Engines; February 1999, pp. 21-1 - 21-25; In English; See also 20000020789; Copyright Waived; Avail: CASI; A03, Hardcopy; A04, Microfiche

A comprehensive assessment is made of the predictive capability of the average passage flow model as applied to multi-stage axial flow compressors. The average passage flow model describes the time average flow field within a typical passage of a blade row embedded in a multi-stage configuration. In this work data taken within a four and one-half stage large low speed compressor will be used to assess the weakness and strengths of the predictive capabilities of the average passage flow model. The low speed compressor blading is of modern design and employs stators with end-bends. Measurements were made with slow and high response instrumentation. The high response measurements revealed the velocity components of both the rotor and stator wakes. Based on the measured wake profiles it will be argued that blade boundary layer transition is playing an important role in setting compressor performance. A model which mimics the effects of blade boundary layer transition within the frame work of the average passage model will be presented. Simulations which incorporated this model showed a dramatic improvement in agreement with data.
Author
Numerical Analysis; Computerized Simulation; Embedding; Flow Distribution; Prediction Analysis Techniques; Turbomachinery

20000020809 Turbomeca S.A. - Brevets Szydlowski, Aerothermodynamic Dept., Bordes, France
PERFORMANCE ANALYSIS OF CENTRIFUGAL COMPRESSOR STAGE, BY MEANS OF NUMERICAL AND EXPERIMENTAL INVESTIGATION OF ROTOR-STATOR INTERACTIONS
Domercq, O., Turbomeca S.A. - Brevets Szydlowski, France; Thomas, R., Turbomeca S.A. - Brevets Szydlowski, France; Carrere, A., Ecole Nationale Superieure de l'Aeronautique et de l'Espace, France; Design Principles and Methods for Aircraft Gas Turbine Engines; February 1999, pp. 22-1 - 22-12; In English; See also 20000020789; Copyright Waived; Avail: CASI; A03, Hardcopy; A04, Microfiche

This paper deals with numerical and experimental investigations of rotor-stator interactions between a backswept centrifugal impeller and its associated vaned diffuser. Experimental data were obtained by laser two focus velocimetry and fast response Kulite transducers. Computations were carried out thanks to a three-dimensional Navier-Stokes solver, customized by the authors, for the current purpose. Time-resolved simulations of the full stage with passages number reduction but respect to real geometry of components are then presented. Comparisons with experimental data lead to a code validation phase and critic investigations of rotor-stator interaction phenomena. Evidence of the existence of a strong interaction between the rotor and the stator flow fields are pointed out. In particular, an intense upstream influence of the vaned diffuser was observed. Finally, steady stage calculations, coupling the components by a mean interfacial treatment, are examined. The reasonable computational cost of this method now allows such numerical simulations of centrifugal stages to be part of design cycles. The numerical part of the study was performed at Turbomeca, using the local software and hardware facilities, whereas the experimental campaign took place in the Propulsion Laboratory of SUPAERO, part of the LAMEP (Laboratoire Mixte en Energetique et Propulsion),

which recently designed a test rig devoted to compressors.
Author
Centrifugal Compressors; Centrifugal Force; Computer Programs; Numerical Analysis; Experimentation; Reliability Analysis; Rotor Stator Interactions

20000020810 Von Karman Inst. for Fluid Dynamics, Turbomachinery Dept., Rhode-Saint-Genese, Belgium
THREE-DIMENSIONAL INVERSE DESIGN METHOD FOR TURBINE AND COMPRESSOR BLADES
Demeulenaere, A., Von Karman Inst. for Fluid Dynamics, Belgium; VandenBraembussche, R. A., Von Karman Inst. for Fluid Dynamics, Belgium; Design Principles and Methods for Aircraft Gas Turbine Engines; February 1999, pp. 23-1 - 23-9; In English; See also 20000020789; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

An iterative procedure for turbomachinery blade design, in which the three-dimensional blade shape is modified by means of a physical algorithm and the transpiration model, is presented. The transpiration flux is defined from the velocity normal to the wall, computed by means of a modified Euler solver when the target pressure distribution is imposed along the blade surfaces. This method is very efficient as it needs only a limited amount of computer time to obtain the required geometry. After a short description of the method this paper focuses on some special features that have been introduced to enhance convergence and to facilitate compliance with required performances and mechanical constraints. Each of these techniques is illustrated with an example.
Author
Computer Aided Design; Turbine Blades; Compressor Blades; Iterative Solution; Reverse Engineering; Algorithms

20000020811 NASA Lewis Research Center, Cleveland, OH USA
A ONE DIMENSIONAL, TIME DEPENDENT INLET/ENGINE NUMERICAL SIMULATION FOR AIRCRAFT PROPULSION SYSTEMS
Garrard, Doug, Sverdrup Technology, Inc., USA; Davis, Milt, Jr., Sverdrup Technology, Inc., USA; Cole, Gary, NASA Lewis Research Center, USA; Design Principles and Methods for Aircraft Gas Turbine Engines; February 1999, pp. 25-1 - 25-10; In English; See also 20000020789
Contract(s)/Grant(s): NASA Order C-71064-E; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

The NASA Lewis Research Center (LeRC) and the Arnold Engineering Development Center (AEDC) have developed a closely coupled computer simulation system that provides a one dimensional, high frequency inlet/engine numerical simulation for aircraft propulsion systems. The simulation system, operating under the LeRC-developed Application Portable Parallel Library (APPL), closely coupled a supersonic inlet with a gas turbine engine. The supersonic inlet was modeled using the Large Perturbation Inlet (LAPIN) computer code, and the gas turbine engine was modeled using the Aerodynamic Turbine Engine Code (ATEC). Both LAPIN and ATEC provide a one dimensional, compressible, time dependent flow solution by solving the one dimensional Euler equations for the conservation of mass, momentum, and energy. Source terms are used to model features such as bleed flows, turbomachinery component characteristics, and inlet subsonic spillage while unstarted. High frequency events, such as compressor surge and inlet unstart, can be simulated with a high degree of fidelity. The simulation system was exercised using a supersonic inlet with sixty percent of the supersonic area contraction occurring internally, and a GE J85-13 turbojet engine.
Author
Engine Design; Computerized Simulation; Supersonic Inlets; Propulsion System Configurations; Mathematical Models; Applications Programs (Computers)

20000020813 Rolls-Royce Ltd., Derby, UK
THE INTRODUCTION OF REINFORCED TMC MATERIALS INTO ROTATING MACHINERY: THE SAFE APPROACH
Doorbar, P. J., Rolls-Royce Ltd., UK; Design Principles and Methods for Aircraft Gas Turbine Engines; February 1999, pp. 27-1 - 27-7; In English; See also 20000020789; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

Titanium metal matrix composites (TMCs) will play a significant role in the future of gas turbine aero-engine development, in particular when used for rotating disc/blade assemblies in axial flow compressors. This paper outlines the potential applications for TMCs and covers some of the main issues involved in the safe introduction of this relatively new class of composite material into critical engine components. The key microstructural features which affect the mechanical performance of finished components are explained, (e.g. fibre damage, fibre placement, interfacial bonding and embrittlement etc.) and illustrations are given of how they can be controlled in the manufacturing process for a complex component.
Author
Metal Matrix Composites; Turbocompressors; Engine Parts

20000020814 Technische Univ., Dept. of Gas Turbines and Flight Propulsion, Darmstadt, Germany
DESIGN OF AN ACTIVE STALL AVOIDANCE SYSTEM FOR A SUBSONIC AXIAL COMPRESSOR
Schulze, R., Technische Univ., Germany; Hennecke, D. K., Technische Univ., Germany; Design Principles and Methods for Aircraft Gas Turbine Engines; February 1999, pp. 28-1 - 28-10; In English; See also 20000020789; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

A single-stage subsonic compressor was examined as a basis for an active stall avoidance system. The process of stall inception was investigated as well as the modes of unstable operation. On the basis of the experimental results, a sensor/actuator scheme was chosen for the control system. A simple and robust stall detection system has been developed and implemented on a real-time computer. The control system's capability of stabilizing the compressor was shown in first experiments. The experiments were analyzed in detail.
CASI
Turbocompressors; Stabilization; Control Systems Design; Rotating Stalls

20000020815 NASA Lewis Research Center, Cleveland, OH USA
ROTATING PIP DETECTION AND STALL WARNING IN HIGH-SPEED COMPRESSORS USING STRUCTURE FUNCTION
Bright, Michelle M., NASA Lewis Research Center, USA; Qammar, Helen, Akron Univ., USA; Vhora, Hanif, Akron Univ., USA; Schaffer, Michael, Akron Univ., USA; Design Principles and Methods for Aircraft Gas Turbine Engines; February 1999, pp. 29-1 - 29-7; In English; See also 20000020789
Contract(s)/Grant(s): NSF CTS-95-02327; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

A statistic for both rotating pip and incipient stall detection, called Structure Function is introduced for use in high speed research compressor environments. Experimental studies on stall inception processes have long observed two types of pre-stall compressor activity. Presently there exist methods for indicating modal stall precursive events in the compressor. This is a first application of a new method to detect rotating pip activity prior to stall in research compressors. The algorithm requires a very short sample of data to distinguish pip activity prior to stall, and thus may be used in a real time application. Additionally, this Structure Function algorithm is also used as a single sensor stall warning method under a variety of operating conditions, including clean inlet conditions, radially and circumferentially distorted inlet conditions, and in examples of steady air injection along the casing, and controlled air injection conditions. Structure Function provides a potential advantage over linear spectral techniques and wavelet algorithms for stall detection due to the simplicity of the algorithm and because it does not rely on a priori knowledge of frequency content.
Author
Rotating Stalls; Turbocompressors; Fault Detection; Prediction Analysis Techniques

20000020816 Von Karman Inst. for Fluid Dynamics, Turbomachinery Dept., Rhode-Saint-Genese, Belgium
TURBOMACHINERY BLADE DESIGN USING A NAVIER-STOKES SOLVER AND ARTIFICIAL NEURAL NETWORK
Pierret, S., Von Karman Inst. for Fluid Dynamics, Belgium; VandenBraembussche, R. A., Von Karman Inst. for Fluid Dynamics, Belgium; Design Principles and Methods for Aircraft Gas Turbine Engines; February 1999, pp. 30-1 - 30-9; In English; See also

20000020789; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

This paper describes a knowledge-based method for the automated design of more efficient turbine blades. Two-dimensional blade sections, defined by Bezier curves as a function of 15 parameters, are first optimized by means of Simulated Annealing (SA) and an Artificial Neural Network (ANN). The later one is an approximate model (response surface) of the 2D Navier-Stokes solutions of previous designs stored in a database. Depending on the performance predicted by a Navier-Stokes analysis the procedure will be stopped or the design cycle will be repeated after the newly designed blade has been added to the database. This extended database allows a more reliable optimization of the blade at next iteration. This procedure results in a considerable speed-up of the design process by reducing both the interventions of the operator and the computational effort. It is also shown how such a method allows the design of more efficient blades while satisfying both the aerodynamic and mechanical constraints. In this paper, emphasis is put on the formulation of a new objective function and its validation by means of three different blade designs.

Author

Turbine Blades; Engine Design; Applications Programs (Computers); Neural Nets; Optimization; Simulated Annealing

20000020817 Societe Nationale d'Etude et de Construction de Moteurs d'Aviation, Turbine Aero and Cooling Dept., Moissy-Cramayel, France

ADVANCED CFD TOOLS FOR MULTI-STAGE TURBINE ANALYSIS

Liamis, N., Societe Nationale d'Etude et de Construction de Moteurs d'Aviation, France; Duboue, J.-M., Societe Nationale d'Etude et de Construction de Moteurs d'Aviation, France; Design Principles and Methods for Aircraft Gas Turbine Engines; February 1999, pp. 31-1 - 31-12; In English; See also 20000020789; Original contains color illustrations; Copyright Waived; Avail: CASI; A03, Hardcopy; A04, Microfiche

The purpose of this contribution is to report on the aerodynamical performance calculations carried out around high and low pressure turbines. Two different turbine configurations are considered : a single stage high pressure turbine including rotor blade tip clearance effects and a four stage low pressure turbine. A multistage approach based on the ONERA-Snecma 3D Navier-Stokes code CANARI is used to investigate the turbine flow behavior. The computational results are compared with experimental data.

Author

Computational Fluid Dynamics; Axial Flow Turbines; Applications Programs (Computers); Performance Prediction

20000020818 Rolls-Royce Ltd., Turbine Engine Systems, Bristol, UK

ADVANCED COMPUTATIONAL FLUID DYNAMICS IN THE DESIGN OF MILITARY TURBINES

Gwilliam, N. J., Rolls-Royce Ltd., UK; Kingston, T. R., Rolls-Royce Ltd., UK; Design Principles and Methods for Aircraft Gas Turbine Engines; February 1999, pp. 32-1 - 32-11; In English; See also 20000020789; Original contains color illustrations; Copyright Waived; Avail: CASI; A03, Hardcopy; A04, Microfiche

Today's design of turbine blade challenges the designer to meet the demanding requirements of overall increase in engine performance - more power for the same weight, greater engine efficiency and fuel economy. This has resulted in designs to cater for higher blade loading and faster rotational speeds. To achieve this, highlift shroudless designs are being adopted. One of the greatest challenges to the aerodynamic designer is the design of such blading so that the additional losses incurred, shock losses, greater secondary flows and susceptability to tip clearance are minimised. To do so, it is essential to be able to carry out an accurate three-dimensional analysis of the flow within the stage. This is achieved using computational fluid dynamics. This paper aims to describe and evaluate some of the tools available at Rolls Royce plc. for the numerical simulation of turbine flows. It was generated as part of a study to analyse a 'datum' and 'highlift' HP (high pressure) turbine, so as to establish both where losses occurred, and which CFD (Computational Fluid Dynamics) codes could best analyse the blading.

Author

Computational Fluid Dynamics; Turbine Blades; Engine Design; Computerized Simulation; Applications Programs (Computers)

20000020819 Motoren- und Turbinen-Union G.m.b.H., Munich, Germany

AUTOMATIC THREE-DIMENSIONAL CYCLIC CRACK PROPAGATION PREDICTIONS WITH FINITE ELEMENTS AT THE DESIGN STAGE OF AN AIRCRAFT ENGINE

Dhondt, G., Motoren- und Turbinen-Union G.m.b.H., Germany; Design Principles and Methods for Aircraft Gas Turbine Engines; February 1999, pp. 33-1 - 33-8; In English; See also 20000020789; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

At MTU a method was devised to perform linear elastic three dimensional (3-D) mixed-mode cyclic crack propagation calculations with the finite element method (FE) in a fully automatic way. The core of the method consists of an algorithm to modify an existing mesh consisting of 20-node 3-D brick elements to accommodate an arbitrarily shaped crack. Starting from the initial crack, the mixed-mode stress intensity factor (K) distribution is determined along the crack front and a crack increment is calculated leading to a new crack shape. This procedure is repeated about every 100 cycles until the desired crack length has been reached. Use of the superelement technique allows to perform more than 100 iterations within 24 hours for a realistic engine component.

Author

Aircraft Engines; Crack Propagation; Finite Element Method; Engine Design; Engine Parts

20000020820 Imperial Coll. of Science Technology and Medicine, London, UK

FORCED RESPONSE PREDICTIONS FOR A HP TURBINE ROTOR BLADE

Vahdati, M., Imperial Coll. of Science Technology and Medicine, UK; Green, J., Rolls-Royce Ltd., UK; Marshall, J. G., Rolls-Royce Ltd., UK; Imregun, M., Imperial Coll. of Science Technology and Medicine, UK; Design Principles and Methods for Aircraft Gas Turbine Engines; February 1999, pp. 34-1 - 34-11; In English; See also 20000020789; Copyright Waived; Avail: CASI; A03, Hardcopy; A04, Microfiche

This paper presents two different strategies for the prediction of blade vibration levels under forced response. The first strategy is an uncoupled approach where the wake forces on the blade are obtained via a linearized aerodynamic model and fed into a reduced structural model. The aeroelastic solution is then performed either in the frequency or the time domain. The second approach is an integrated non-linear analysis that considers a multi-stage multi-passage and that includes the flexibility of the rotor blades. The analysis is then conducted in the time domain using non-linear unsteady aerodynamics. A case study was conducted for a HP turbine stage with 36 stator and 92 rotor blades. The response levels to a 36 engine order excitation were predicted using both the linearized uncoupled and nonlinear integrated approaches and the findings were compared with available experimental data. Good overall agreement was reached for most of the cases studied.

Author

Turbine Blades; Forced Vibration; Aerodynamic Forces; Rotor Blades (Turbomachinery)

20000020821 Pennsylvania State Univ., Dept. of Aerospace Engineering, University Park, PA USA

AERO-THERMO-STRUCTURAL DESIGN OPTIMIZATION OF INTERNALLY COOLED TURBINE BLADES

Dulikravich, G. S., Pennsylvania State Univ., USA; Martin, T. J., Pennsylvania State Univ., USA; Dennis, B. H., Pennsylvania State Univ., USA; Lee, E., Pennsylvania State Univ., USA; Han, Z.-X., Pennsylvania State Univ., USA; Design Principles and Methods for Aircraft Gas Turbine Engines; February 1999, pp. 35-1 - 35-12; In English; See also 20000020789

Contract(s)/Grant(s): NAG3-1995; NSF DMI-95-22854; Copyright Waived; Avail: CASI; A03, Hardcopy; A04, Microfiche

A set of robust and computationally affordable inverse shape design and automatic constrained optimization tools have been developed for the improved performance of internally cooled gas turbine blades. The design methods are applicable to the aerody-

namics, heat transfer, and thermoelasticity aspects of the turbine blade. Maximum use of the existing proven disciplinary analysis codes is possible with this design approach. Preliminary computational results demonstrate possibilities to design blades with minimized total pressure loss and maximized aerodynamic loading. At the same time, these blades are capable of sustaining significantly higher inlet hot gas temperatures while requiring remarkably lower coolant mass flow rates. These results suggest that it is possible to design internally cooled turbine blades that will cost less to manufacture, will have longer life span, and will perform as good, if not better than, film cooled turbine blades.
Author
Structural Design; Turbine Blades; Design Analysis; Gas Turbines; Computational Fluid Dynamics; Multidisciplinary Design Optimization

20000020822 Rolls-Royce Ltd., Turbine Research, Bristol, UK
THE BENEFITS OF A ROTATING RIG FOR RESEARCH INTO ADVANCED TURBINE COOLING SYSTEMS
Davenport, R., Rolls-Royce Ltd., UK; Design Principles and Methods for Aircraft Gas Turbine Engines; February 1999, pp. 37-1 - 37-9; In English; See also 20000020789; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

Internal cooling of turbine blades is essential for efficient turbine engine performance and dictates the life of the component. Engine specific thrust and efficiency benefit from blade cooling although the use of cooling air imposes cycle penalties and can reduce aerodynamic efficiency. Cooling research aims to develop and validate design methods to give maximum cooling effectiveness for minimum cooling flow. The design methods need to be reliable reducing the risks in future projects thus helping to avoid in-service short falls and high maintenance costs. Current design methods have been almost exclusively derived from experiments performed using simplified cooling geometries without the influence of rotation, which is perfectly feasible for nozzle guide vane designs but sadly lacking for rotor designs. However, it is important to pursue both static and rotating experiments to establish the effects of rotation and to determine design rules that allow corrections to static experimental data. All the experimental data can be used to validate Computational Fluid Dynamics (CFD) modelling which has difficulty in predicting heat transfer levels in highly turbulent 3D flows.
Author
Computational Fluid Dynamics; Cooling Systems; Engine Design; Design Analysis

20000020823 NASA Lewis Research Center, Cleveland, OH USA
SIMULATION OF CRACK PROPAGATION IN ENGINE ROTATING COMPONENTS UNDER VARIABLE AMPLITUDE LOADING
Bonacuse, P. J., Army Research Lab., USA; Ghosn, L. J., Case Western Reserve Univ., USA; Telesman, J., NASA Lewis Research Center, USA; Calomino, A. M., NASA Lewis Research Center, USA; Kantzos, P., Ohio Aerospace Inst., USA; Design Principles and Methods for Aircraft Gas Turbine Engines; February 1999, pp. 38-1 - 38-8; In English; See also 20000020789; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

The crack propagation life of tested specimens has been repeatedly shown to strongly depend on the loading history. Overloads and extended stress holds at temperature can either retard or accelerate the crack growth rate. Therefore, to accurately predict the crack propagation life of an actual component, it is essential to approximate the true loading history. In military rotorcraft engine applications, the loading profile (stress amplitudes, temperature, and number of excursions) can vary significantly depending on the type of mission flown. To accurately assess the durability of a fleet of engines, the crack propagation life distribution of a specific component should account for the variability in the missions performed (proportion of missions flown and sequence). In this report, analytical and experimental studies are described that calibrate/validate the crack propagation prediction capability for a disk alloy under variable amplitude loading. A crack closure based model was adopted to analytically predict the load interaction effects. Furthermore, a methodology has been developed to realistically simulate the actual mission mix loading on a fleet of engines over their lifetime. A sequence of missions is randomly selected and the number of repeats of each mission in the sequence is determined assuming a Poisson distributed random variable with a given mean occurrence rate. Multiple realizations of random mission histories are generated in this manner and are used to produce stress, temperature, and time points for fracture mechanics calculations. The result is a cumulative distribution of crack propagation lives for a given, life limiting, component location. This information can be used to determine a safe retirement life or inspection interval for the given location.
Author
Crack Propagation; Engine Parts; Computerized Simulation; Variable Amplitude Loading

20000020824 Oxford Univ., Dept. of Engineering Science, Oxford, UK
THEORY FOR THE USE OF FOREIGN GAS IN SIMULATING FILM COOLING
Jones, T. V., Oxford Univ., UK; Design Principles and Methods for Aircraft Gas Turbine Engines; February 1999, pp. 39-1 - 39-8; In English; See also 20000020789; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

In the film cooling of turbines the coolant is significantly cooler than the freestream. Consequently the coolant is at a higher density and this plays an important role in determining the flowfield. In laboratory experiments with small temperature differences this density difference is simulated by using dense foreign gas. This paper analyses the effect of molecular properties on the thermal measurements so that they may be related to the cold air situation.
Author
Film Cooling; Computerized Simulation

20000020825 Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Inst. of Materials Research, Cologne, Germany
THE POTENTIAL OF ADVANCED MATERIALS ON STRUCTURAL DESIGN OF FUTURE AIRCRAFT ENGINES
Kumpfert, J., Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; Peters, M., Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; Kaysser, W. A., Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; Design Principles and Methods for Aircraft Gas Turbine Engines; February 1999, pp. 42-1 - 42-12; In English; See also 20000020789; Copyright Waived; Avail: CASI; A03, Hardcopy; A04, Microfiche

For a gas turbine engine manufacturer the direct operating costs (DOC) of aircraft engines is primarily reduced by control of fuel costs, maintenance costs, and through weight savings. All aspects are strongly influenced by the materials technology available and can improve the component efficiency significantly. The recent development of conventional high temperature titanium alloys has demonstrated the in-service capabilities of conventional materials due to better understanding of microstructure/property relationships. Beyond these capabilities new light-weight materials as titanium aluminides and titanium matrix composites (TMCs) may improve engine performance significantly. In particular TMCs can improve compressor efficiency by enabling new compressor design not feasible with any other material used today. Increased turbine efficiency depends primarily on the gas turbine inlet temperature. To further increase the thrust-to-weight ratio and decrease the specific fuel consumption new aircraft engines will require gas turbine inlet temperatures well beyond 1600 C. Since new structural high temperature materials capable of service temperatures significantly above current high pressure turbine temperatures are not feasible in short-term other innovative technologies are required. This is in particular through the introduction of electron-beam physical vapor deposition (EB-PVD) thermal barrier coatings (TBCs). Reduced emissions and lower specific fuel consumption (SFQ) of next generation jet engines depend predominantly on new combustor design. Very low emission combustors require revolutionary materials as ceramic matrix composites (CMCs) to replace the metallic liner currently in use. The potential payoff, processing, and properties of conventional high temperature titanium alloys, titanium aluminides, TMCs, TBCs, and CMCs are highlighted regarding applications in aircraft engines.
Author
Structural Design; Aircraft Design; Aircraft Engines; Ceramic Matrix Composites

20000020826 Rolls-Royce Ltd., Performance Systems, Bristol, UK
CYCLE-MATCH ENGINE MODELS USED IN FUNCTIONAL ENGINE DESIGN: AN OVERVIEW

Horobin, Marcus S., Rolls-Royce Ltd., UK; Design Principles and Methods for Aircraft Gas Turbine Engines; February 1999, pp. 44-1 - 44-22; In English; See also 20000020789; Copyright Waived; Avail: CASI; A03, Hardcopy; A04, Microfiche

The wider use of iterative thermodynamic (cycle-match) engine models across the functional design process offers many technical and organizational benefits which contribute to reduced risk in engine development programmes. The use of low and high order engine models for control-system design and validation is used to illustrate some of these advantages. The principles of the iterative technique are discussed with reference to the extra capabilities required of models used for control-system design and validation. Some related issues e.g. increased model capability, complexity and user-acceptability are also discussed.

Author

Engine Design; Thermodynamic Cycles; Functional Design Specifications; Design Analysis

20000020827 Kansas Univ., Aerospace Engineering Dept., Lawrence, KS USA

SMART FLOW CONTROL IN AIRCRAFT ENGINE COMPONENTS AND COMPONENT INTERACTIONS

Farokhi, S., Kansas Univ., USA; Design Principles and Methods for Aircraft Gas Turbine Engines; February 1999, pp. 45-1 - 45-11; In English; See also 20000020789; Copyright Waived; Avail: CASI; A03, Hardcopy; A04, Microfiche

Adverse flow environments pose challenging design constraints in aircraft engine components and component interactions. Some examples of such flow environments are: steep pressure gradients, random and periodic unsteadiness, shock wave interactions and 3-D boundary layer separation. These adverse flow environments and interactions promote the growth of various kinds of instability waves inherent in gas turbine engines, e.g., vorticity wave, entropy wave and acoustic or pressure wave instabilities. A series of smart subsonic and supersonic flow controllers are presented with applications to the design of aircraft gas turbine engine components. They are on-demand vortex generators capable of injecting co- and counter-rotating streamwise vortices in subsonic, transonic and supersonic flow. The strength and location of the vortex is a control variable and must be optimized via a closed-loop control algorithm. The subsonic smart Vortex Generator (VG) assumes a ramp-type geometry (similar to Wheeler vortex generators) and the smart supersonic VG is a tailored cavity with a movable flap concealing the cavity. The movable flap is actuated inward to expose the cavity to transonic or supersonic flow. The depth of the cavity is controlled via a closed-loop feedback control system which ties the strength of the vortex to the 'desired' performance as measured by one or more sensors. Candidate cost functions are proposed in the optimization routine for each component in a gas turbine engine.

Author

Flow Characteristics; Aircraft Engines; Design Analysis; Aircraft Design

20000020828 Naval Air Systems Command, Propulsion and Power Engineering, Patuxent , MD USA

F/A-18 E/F AIRCRAFT ENGINE (F414-GE-400) DESIGN AND DEVELOPMENT METHODOLOGY

Burnes, Robert, Naval Air Systems Command, USA; Blottenberger, Don, Naval Air Systems Command, USA; Elliott, Michael, Naval Air Systems Command, USA; Design Principles and Methods for Aircraft Gas Turbine Engines; February 1999, pp. 46-1 - 46-12; In English; See also 20000020789; Copyright Waived; Avail: CASI; A03, Hardcopy; A04, Microfiche

In the 1970's the USA Navy (USN) faced a dilemma. The F-4 Phantom and A-7 Corsair aircraft were aging rapidly and new threats were arising as technology advanced. To answer the call for a new attack fighter, the USN developed and deployed the F/A-18 aircraft. In 1987, the Secretary of Defense directed the USN to study advanced versions of the F/A-18 to face threats into the twenty-first century. This study resulted in the F/A-18 E/F. The F/A-18 E/F represents the next level in the evolution of the F/A-18 Attack Fighter. From the beginning, the objective has remained stable; to define an affordable system taking full advantage of the cost benefits associated with a derivative system without compromise of mission capabilities.

Derived from text

Aircraft Engines; Engine Design

20000020846 Defence Evaluation Research Agency, Combustion and Emissions Section, Farnborough, UK

MEASUREMENT AND PREDICTION OF NO AND NO2 EMISSIONS FROM AERO ENGINES

Foster, T. J., Defence Evaluation Research Agency, UK; Wilson, C. W., Defence Evaluation Research Agency, UK; Pourkashanian, M., Leeds Univ., UK; Williams, A., Leeds Univ., UK; Gas Turbine Engine Combustion, Emissions and Alternative Fuels; June 1999, pp. 19-1 - 19-9; In English; See also 20000020829; Original contains color illustrations; Copyright Waived; Avail: CASI; A02, Hardcopy; A06, Microfiche

Aircraft fitted with afterburner systems for increased thrust have been observed to have NOx emissions with a higher proportion of nitrogen dioxide (N02) than non-augmented aircraft. These emissions are generally characterised by a brown plume and has implications for aircraft visibility and stealth as well as environmental considerations. This paper describes the CFD modelling of NOx emissions from a modern afterburner system. A commercial CFD code, Fluent, was used to develop and solve a three dimensional model of a 'burn then mix' afterburner system under investigation. A post processor package has been developed and was used to calculate both NO and NO2 concentrations. Four reheat settings were investigated; minimum, 25%, 50% and maximum reheat. For all conditions investigated the bulk of NOx emission was found in the core, stemming from the vitiated combustor air flow. NOx was also formed in the bypass stream, the production zone was found to be close to the fuel sprayers and flame stabiliser at minimum reheat, but moved downstream towards the exit nozzle as reheat power was increased. The model showed that for all the conditions under investigation, over 90% of the NOx produced in the reheat system was formed via the thermal-NO route. The model has been compared with centre-line traverse data measured at the exit nozzle of the engine on a sea-level static test bed. The predicted NOx emissions agreed quantitatively with the experimental measurements to within +/- 5%

Author

Afterburning; Nitrogen Dioxide; Nitrogen Oxides; Exhaust Emission; Plumes; Gas Turbine Engines; Three Dimensional Models

20000020847 Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Inst. of Propulsion Technology, Cologne, Germany

INFLUENCE OF ENGINE PERFORMANCE ON EMISSION CHARACTERISTICS

Doepelheuer, A., Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; Lecht, M., Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; Gas Turbine Engine Combustion, Emissions and Alternative Fuels; June 1999, pp. 20-1 - 20-12; In English; See also 20000020829; Copyright Waived; Avail: CASI; A03, Hardcopy; A06, Microfiche

This paper concentrates on the results of different investigations on aircraft engine emissions. In a first step semi-empirical emission correlation methods to predict the sum of nitric oxide and nitrogen dioxide (NOx), carbon monoxide (CO), hydrocarbons (HC) and soot are introduced. They all are of a 'variable' reference type meaning, that published sea level static (SLS) measurements will be used as a reference. To calculate the amount of emissions for altitude operating conditions, the actual parameters involved like the fuel flow (for the NOx correlation method), the reciprocal value of the combustor loading parameter (for the CO and HC correlation methods) and the combustor inlet temperature and pressure, the flame temperature and the equivalence ratio (for the soot correlation method) are set into relation to the respective reference ground values. The necessary internal engine parameters are received from a thermodynamic engine modelling program shortly described in this paper. Because of the fact, that the engine thermodynamic state is mainly determined by the thrust demand of the aircraft and the ambient conditions, not only engines, but also aircraft engine combinations on different flight missions had to be looked at. Therefore a flight performance module is presented, which allows - in combination with the engine modelling program and the emission calculation methods detailed simulations and investigations of flight missions on the entire route. As a result not only the effects of engine performance modes and parameters (like bypass ratio in combination with overall pressure ratio) but also the effects of ambient conditions (like wind and ambient temperature) and flight profile (like cruise altitude, step climb, take off weight and payload factor) on the fuel burned and the emissions produced by different engines and

aircraft in use are investigated. Finally the results of a comparison between a subsonic and a supersonic mission and a comparison between a jet aircraft of the first generation and a modern type are given.
Author
Aircraft Engines; Exhaust Emission; Propulsion System Performance; Environment Effects; Pollution; Thermodynamics; Mathematical Models

20000020854 Defence Evaluation Research Agency, Propulsion Dept., Farnborough, UK
A NOVEL TECHNIQUE FOR PREDICTING THE IGNITION PERFORMANCE OF AN AERO GAS TURBINE COMBUSTION CHAMBER
Wilson, C. W., Defence Evaluation Research Agency, UK; Sheppard, C. G. W., Leeds Univ., UK; Low, H. C., Rolls-Royce Ltd., UK; Gas Turbine Engine Combustion, Emissions and Alternative Fuels; June 1999, pp. 29-1 - 29-12; In English; See also 20000020829; Original contains color illustrations; Copyright Waived; Avail: CASI; A03, Hardcopy; A06, Microfiche

The work reported in this report is directed towards improvements in the ignition of gas turbine combustors. Currently available design rules are incapable of predicting the improved performance obtained with different ignition systems or igniter placement. Work has been carried out to address the inadequacies, in the current ignition prediction techniques, using Computational Fluid Dynamics (CFD). A preliminary validation of the CFD ignition prediction technique was performed using ignition results from a fully annular research combustor. Qualitatively, the effect of igniter position, igniter type and combustor mass flow rate on ignition performance have been predicted, by inspection of the Karlovitz number encountered by a tracer, used to model a developing ignition kernel.
Author
Combustion Chambers; Ignition Systems; Gas Turbine Engines; Igniters; Performance Prediction

20000032862 Air Force Research Lab., Materials and Manufacturing Directorate, Wright-Patterson AFB, OH USA
MATERIAL ALLOWABLES FOR HIGH CYCLE FATIGUE IN GAS TURBINE ENGINES
Nicholas, T., Air Force Research Lab., USA; Application of Damage Tolerance Principles for Improved Airworthiness of Rotorcraft; February 2000, pp. 4 - 1 - 4 - 9; In English; See also 20000032859; Copyright Waived; Avail: CASI; A02, Hardcopy

HCF failures in materials used in both static and rotating components of gas turbine engines have often been found to be attributable to fatigue loading on materials which have sustained some type of damage. Damage can be present from initial material or manufacturing defects, or can develop during service operation. In-service damage, while not catastrophic by itself, can degrade the HCF resistance of the material below that for which it was designed. Three major sources of in-service damage which can alter the HCF capability individually or in conjunction with one another are low cycle fatigue (LCF), foreign object damage (FOD), and contact fatigue. Other types of damage include creep, corrosion and thermal fatigue. The present design methodology is highly empirical and relies heavily on service experience to establish material allowable knockdown factors for each type of damage. To reduce HCF failures, the U.S. Air Force is developing a damage tolerant approach which addresses these issues in a less empirical manner. The effects of damage on HCF capability and a discussion of the material allowables under HCF are presented.
Author
Gas Turbine Engines; Damage; Structural Analysis; Systems Health Monitoring; Fatigue Tests; Structural Failure; Fatigue (Materials); Metals

20000037815 Rolls-Royce Allison, Indianapolis, IN USA
ACHIEVING HELICOPTER MODERNIZATION WITH ADVANCED TECHNOLOGY TURBINE ENGINES
Dickens, Fred W., Rolls-Royce Allison, USA; Thomason, Tommy, Rolls-Royce Allison, USA; Advances in Vehicle Systems Concepts and Integration; April 2000, pp. A18-1 - A18-9; In English; See also 20000037804; Copyright Waived; Avail: CASI; A02, Hardcopy

Military and commercial helicopter operators worldwide are faced with a common dilemma-when to replace existing fleets with newer, more capable, and yes, more expensive helicopters. Alternatively, how often and how much should they spend on upgrades. Either decision may be based on operational needs, operational support costs, or a combination of both. On a personal level, you go through a similar process when deciding to replace the family car with a new or used car. As long as the basic mission remains unchanged, such as the daily commute to and from work, and the vehicle is reliable and replacement parts are readily available, then you probably can't economically rationalize a new car. Automobile upgrades are virtually limitless as there are many sources for new engines, radios, security systems, power door locks, stereo systems, cruise controls, trailer hitches, and fog lights, among others. All of these options serve the same purpose: to make an existing car more functional or to extend its life. A replacement can be rationalized when repair costs become too expensive, you experience a major failure, the car is no longer reliable, fuel costs or fuel consumption become prohibitive, or there is no longer room for the growing family. Likewise, there are many examples where helicopter replacements are necessary in lieu of upgrades. Helicopter replacements are appropriate when the mission need and capability of the replacement is so compelling that upgrades to the existing system are simply cost prohibitive and/or the desired performance is not achievable within the existing airframe structure. Crashworthiness, cargo volume, night/adverse weather capability, payload, range, speed, battle damage vulnerability, multi-engine requirements, and marinization, among many other considerations, might contribute to the replacement decision. A few examples of cost and mission effective replacement helicopters are listed in Figure 1. The replacement of the CH-46 helicopter with the V-22 Osprey tiltrotor is the most compelling example of an extraordinary aircraft capability redefining an operational mission.
Author
Turbine Engines; Upgrading; Military Helicopters; Aircraft Engines

20000037816 Societe Nationale d'Etude et de Construction de Moteurs d'Aviation, Military Engines Div., Evry, France
THE MODERNIZATION OF SNECMA MILITARY ENGINES: RECENT DEVELOPMENTS AND PERSPECTIVES *[LA MODERNISATION DES MOTEURS MILITAIRES SNECMA DEVELOPPEMENTS RECENTS ET PERSPECTIVES]*
Coquelet, Michel, Societe Nationale d'Etude et de Construction de Moteurs d'Aviation, France; Advances in Vehicle Systems Concepts and Integration; April 2000, pp. A20-1 - A20-6; In French; See also 20000037804; Copyright Waived; Avail: CASI; A02, Hardcopy

To date, 47 armed forces have used over 6,000 engines sold by Snecma of CFMI, the common (50/50) subsidiary of Snecma (France) and GE (US). Among the engines currently in use, some have been in service for over 30 years. In order to maintain a high level of satisfaction among our clientele, Snecma has adopted an agenda of continuous improvement, including: Extending life span and reducing maintenance costs; Proposing modifications due to changes in use; Industry participation in client countries.
Author
Aircraft Engines; Product Development; Aircraft Production

20000037894 Naval Air Systems Command, Patuxent , MD USA
THE DEVELOPMENT AND OPERATIONAL CHALLENGES OF UAV AND UCAV AIRBREATHING PROPULSION
Cifone, Anthony, Naval Air Systems Command, USA; Parsons, Wayne, Naval Air Systems Command, USA; Development and Operation of UAVs for Military and Civil Applications; April 2000, pp. 6-1 - 6-14; In English; See also 20000037887; Copyright Waived; Avail: CASI; A03, Hardcopy

There are a large number of Unmanned Aerial Vehicles (UAVs) throughout the world performing a variety of functions. The variety of conditions under which they operate, e.g., speed, altitude, endurance, VTOL, payload etc. impact or limit the type and size of propulsion system needed. This paper will define the various UAV categories and will characterize the types of engines and propulsors available for them. The variability of design features and their effect on characteristics will be shown. The effect of propulsion system trades on total system capability will be discussed.
Derived from text
Air Breathing Engines; Pilotless Aircraft

20000038013 Research and Technology Organization, Applied Vehicle Technology Panel, Neuilly-sur-Seine, France
RECOMMENDED PRACTICES FOR MONITORING GAS TURBINE ENGINE LIFE CONSUMPTION *[PRATIQUES RECOMMANDEES POUR LE CONTROLE DU VIEILLISSEMENT DES TURBOMOTEURS]*
April 2000; 181p; In English; CD-ROM contains full text document in PDF format
Report No.(s): RTO-TR-28; AC/323(AVT)TP/22; ISBN 92-837-1032-0; Copyright Waived; Avail: CASI; A09, Hardcopy; A02, Microfiche; C01, CD-ROM

The Task Group analysed the use of life monitoring systems in modern engines (from 1990) and in ageing fleets. The design and operational factors to be considered beforehand are described. Particular attention is paid to turbine disks. Regulatory requirements for safety standards are considered. Civil military practices, maintenance policies and procedures, modes and mechanics of service usage are covered as well as their influence on life consumption. Lifting procedures, monitoring system verification and validation, operational management considerations an usage monitoring approaches are dealt with.
Author
Gas Turbine Engines; Engine Monitoring Instruments; Systems Health Monitoring

20000119928 General Electric Co., Aircraft Engines, Cincinnati, OH USA
JSF F120 ENGINE PROGRAM. LOW COST OPERATION AND SUPPORT: AN ENGINE MANUFACTURER'S PERSPECTIVE
Murphy, K., General Electric Co., USA; Smith, J., General Electric Co., USA; Wensits, D., Allison Advanced Development Co., USA; Design for Low Cost Operation and Support; September 2000, pp. 11-1 - 11-4; In English; See also 20000119918; Copyright Waived; Avail: CASI; A01, Hardcopy

The JSF F120 engine is being developed specifically to meet the overall affordability objectives of the JSF Program, addressing all elements of cost from development through operation and support. Uniquely different from current systems, the JSF affordability focus is driving fundamental changes in the engine configuration and development, acquisition, and support processes to facilitate meeting these overall affordability goals. Although these changes influence all aspects of the F120 engine design, one of the critical elements to meeting these objectives is improving the supportability characteristics of engine. Improved supportability, implemented through increased reliability, improved safety, reduced maintenance, and flexible support systems, will result in lower overall operation and support costs over the life of the weapon system. These improvements will facilitate the affordable operation of the F120-based propulsion system. To meet the desired supportability improvements, the F120 engine is being designed as an inherently more robust, lower variation system based on the Team's Six Sigma initiatives to positively impact maintenance and support costs yielding lower total cost of ownership for our customers. The F120 engine design process is focused on configuration simplicity, full 3D simulation, advanced diagnostics, and support system flexibility to achieve the desired cost benefit. The F120 engine's simplicity, with significantly fewer parts than current engine systems, provides the basis for improved reliability and lower cost. Each of these parts is being designed in a full 3D Visualization and modeling environment to permit full assessment of maintenance and support needs during the design process. Overall, the engine will utilize an advanced Prognostics and Health Management (PHM) system, combined with the weapon system's Integrated Flight Propulsion Control (IFPC), Vehicle Management System (VMS) and advanced information processing systems, to provide specific data on the health of the engine to facilitate 'oncondition' maintenance and support. Combined with the engine's PHM system is the ability to provide a flexible customer support system to facilitate the operation and support needs of the weapon system's various customers. This flexibility permits easy adaptability to both today's and future systems capitalizing on different partnerships between government and industry. Integrating these focused activities will permit the GE/AADC/RR Team to provide an F120 engine system that optimizes the balance between reliability, maintainability. and support resources to deliver a low cost, maintenance friendly system ultimately meeting affordability objectives.
Author
Low Cost; Operating Costs; Cost Reduction; Cost Analysis; Design To Cost; Life Cycle Costs

20000119929 Rolls-Royce Ltd., Bristol, UK
IMPLICATIONS OF 'POWER BY THE HOUR' ON TURBINE BLADE LIFING
Bagnall, S. M., Rolls-Royce Ltd., UK; Shaw, D. L., Rolls-Royce Ltd., UK; Mason-Flucke, J. C., Rolls-Royce Ltd., UK; Design for Low Cost Operation and Support; September 2000, pp. 12-1 - 12-10; In English; See also 20000119918; Copyright Waived; Avail: CASI; A02, Hardcopy

'Power by the Hour' engine sales contracts are becoming popular both amongst engine operators and engine manufacturers. This paper examines how accurate turbine blade life prediction is achieved and is combined with accurate measurement of damage in service for successful contract fulfillment.
Derived from text
Turbine Blades; Engine Parts; Life (Durability); Predictions

20010002549 General Electric Co., Aircraft Engines, Cincinnati, OH USA
JS5 REJUVENATION THROUGH TECHNOLOGY INSERTION
Brisken, T. A., General Electric Co., USA; Howell, P. N., General Electric Co., USA; Ewing, A. C., General Electric Co., USA; Aging Engines, Avionics, Subsystems and Helicopters; October 2000, pp. 1-1 - 1-11; In English; See also 20010002548; Copyright Waived; Avail: CASI; A03, Hardcopy

The history of the General Electric 585 turbojet engine is presented from its early inception as a single-use drone engine to its equipping of almost 3000 frontline fighter and attack aircraft. The technology development to enable this progression and provide support of over 7000 in-service engines is further discussed, allowing its continued use for the next 40 years. Specific examples of technology insertion are detailed, including a discussion of the innovative program leading to upgrade of the J85-powered T-38 fleet and options for the rest of the world's air forces. thrust to weight ratio turbojet engines with potential application to early cruise missiles and drones. Initially using a compressor with only seven stages, a configuration using eight stages was finally settled on to provide for adequate performance margin, which proved to be prophetic. These design efforts resulted in the J85-GE-1 engine, and at 1900-2100 lbs. of dry thrust powered the GAM-72/ADM-20 Quail decoy missile deployed on USAF B-52 bombers. Besides needing high thrust in a lightweight package, most other requirements were fairly benign. A reasonable airstart envelope was specified due to its being an air-launched missile, and a 30 minute, one-way mission life was all that was needed.
Author
Technology Utilization; Jet Aircraft; Compressors; Rotors; Ejectors; Aircraft Design

20010002550 National Research Council of Canada, Inst. for Aerospace Research, Ottawa, Ontario Canada
THE AGING OF ENGINES: AN OPERATOR'S PERSPECTIVE
Immarigeon, J-P., National Research Council of Canada, Canada; Koul, A. K., National Research Council of Canada, Canada; Beres, W., National Research Council of Canada, Canada; Au, P., National Research Council of Canada, Canada; Fahr, A., National Research Council of Canada, Canada; Wallace, W., National Research Council of Canada, Canada; Patnaik, P. C., Orenda Aerospace Corp., Canada; Thamburaj, R., Orenda Aerospace Corp., Canada; Aging Engines, Avionics, Subsystems and Helicopters; October 2000, pp. 2-1-2-20; In English; See also 20010002548; Copyright Waived; Avail: CASI; A03, Hardcopy

NATO countries are currently faced with the need to operate fleets of mature gas turbine engines built many years ago. Because of diminishing resources for new equipment, the prospects of replacing these engines with new ones are not good at present. How long such engines can be kept in service safely, without replacing a significant portion of their aging structural components has become a growing concern to engine life-cycle managers, due to uncertainties in residual lives. Another concern is the high maintenance cost associated with the replacement of durability-critical components,

such as blades and vanes. The need to balance risk and escalating maintenance costs explains the growing interest in the application of life extension technologies for safely extracting maximum usage out of life-limited parts. In the case of aero-engines, maintaining airworthiness while ensuring affordability is of prime concern to both life-cycle managers and regulatory authorities. This lecture describes the modes of deterioration of engine components and discusses their effects on the performance, operating costs, reliability, and operational safety of engines. It also identifies component life extension strategies that engine life-cycle managers may adopt to cost-effectively manage their engines, while ensuring reliability and safety. A qualification methodology for component life extension, developed and implemented for Canadian Forces engines, is presented. The methodology incorporates an Engine Repair Structural Integrity Program (ERSIP) that was conceived to establish structural performance requirements and identify tests for development and qualification of life extension technologies, to ensure structural integrity and performance throughout the extended life. Examples of life extension technologies applied to gas path components and critical rotating parts are described, including the use of protective coatings and repairs to increase component durability. The application of damage tolerance concepts to allow use of safety-critical parts beyond their conventional safe-life limits is also illustrated.
Author
Aircraft Reliability; Deterioration; Durability; Maintenance; Aging (Materials); Aircraft Safety

20010028479 Societe Nationale d'Etude et de Construction de Moteurs d'Aviation, Military Div., Evry, France
SNECMA ATAR ENGINES COST EFFECTIVE MAINTENANCE IN A 1960-2020 LIFE TIME
Coquelet, Michel, Societe Nationale d'Etude et de Construction de Moteurs d'Aviation, France; Aging Aircraft Fleets: Structural and Other Subsystem Aspects; March 2001, pp. 3-1 - 3-7; In English; See also 20010028476; Original contains color illustrations; Copyright Waived; Avail: CASI; A02, Hardcopy

Today, 47 airforces are operating more than 6000 engines sold by Snecma or by CFMI, the joint company (50/50) of Snecma (France) and GE (USA). Among those engines, some have been operated for more than 30 years. The Snecma product and service continuous improvement covers: a) Life extension and and maintenance cost reduction programs; b) Modifications proposals triggered by mission profile evolution; and c) Better involvement of customers national industry.
Derived from text
Aircraft Engines; Life (Durability); Cost Effectiveness

20010028484 Technische Univ., Structural Mechanics, Munich, Germany
EXTENSION OF THE USABLE ENGINE LIFE BY MODELLING AND MONITORING
Pfoertner, Hugo, Technische Univ., Germany; Aging Aircraft Fleets: Structural and Other Subsystem Aspects; March 2001, pp. 8-1 - 8-19; In English; See also 20010028476; Copyright Waived; Avail: CASI; A03, Hardcopy

After providing some commonly used definitions of fracture critical parts, the influence of improved calculation methods on the design of such components is shown. Various approaches to the determination of usable fatigue life are discussed, particularly the classical safe life philosophy and approaches exploiting the damage tolerance of components. Within this general framework there exist various possible lifing policies, that have to be discussed and agreed between the engine manufacturer, the users and the regulatory agencies. The methods for life usage management may be adapted to changing environments, taking into account the experience gained during operational usage. The introduction of recording or monitoring systems makes it possible to calculate the actual life usage of individual components or at least to determine the scatter of usage within an aircraft fleet. These results enable a specific exploitation of the life potential of the parts without giving rise to an increased risk. The use of the life potential beyond the safe crack initiation life requires experimental and computational methods to gain insight into the fracture mechanical processes governing crack propagation. The corresponding results can also be used to determine inspection intervals that ensure a detection of cracks before those cracks start uncontrolled growth. Results from an on-board life usage monitoring system used by the German air force are presented. An outline of the tasks of usage monitoring is given. Finally some remarks on fleet management are presented.
Derived from text
Fatigue Life; Inspection; Crack Propagation; Crack Initiation; Fracturing

20010067673 Cambridge Univ., Dept. of Engineering, Cambridge, UK
ACTIVE CONTROL OF INSTABILITIES IN GAS TURBINES
Dowling, A. P., Cambridge Univ., UK; Active Control Technology for Enhanced Performance Operational Capabilities of Military Aircraft, Land Vehicles and Sea Vehicles; June 2001, pp. K2-1 - K2-12; In English; See also 20010067671; Copyright Waived; Avail: CASI; A03, Hardcopy

Active control of instabilities of compression and combustion systems is reviewed within a common framework. It is over ten years since the first full-scale demonstration of the feasibility of feedback control to delay the onset of instability in gas turbines. But challenges remain. In particular, practical implementation requires controllers that have guaranteed performance across a range of engine operating conditions and the development of robust sensors and actuators that continue to function over many tens of thousands of hours of running.
Author
Active Control; Combustion Stability; Flow Distribution; Controllers; Actuators

20010067685 Industria de Turbo Propulsores S.A., Parque Tecnologico, Zamudio, Spain
THRUST VECTORING NOZZLE FOR MODERN MILITARY AIRCRAFT
Ikaza, Daniel, Industria de Turbo Propulsores S.A., Spain; Active Control Technology for Enhanced Performance Operational Capabilities of Military Aircraft, Land Vehicles and Sea Vehicles; June 2001, pp. 11-1 - 11-11; In English; See also 20010067671; Original contains color illustrations; Sponsored in part by Eurojet and Fiat-Avio; Copyright Waived; Avail: CASI; A03, Hardcopy

This paper describes the technical features of the Thrust Vectoring Nozzle (TVN) developed by ITP (Industria de Turbo Propulsores) and its advantages for modern military aircraft. It is presented in conjunction with two other papers by DASA (Thrust Vectoring for Advanced Fighter Aircraft High Angle of Attack Intake Investigations) and MTU-Muenchen (Integrated Thrust Vector Jet Engine Control), respectively.
Author
Thrust Vector Control; Convergent-Divergent Nozzles

20010067686 Motoren- und Turbinen-Union G.m.b.H., Munich, Germany
INTEGRATED THRUST VECTORED ENGINE CONTROL
Christian, Rausch, Motoren- und Turbinen-Union G.m.b.H., Germany; Klaus, Lietzau, Motoren- und Turbinen-Union G.m.b.H., Germany; Active Control Technology for Enhanced Performance Operational Capabilities of Military Aircraft, Land Vehicles and Sea Vehicles; June 2001, pp. 12-1 - 12-9; In English; See also 20010067671; Original contains color illustrations; Copyright Waived; Avail: CASI; A02, Hardcopy

Thrust vectoring has the potential to provide significant improvements in combat aircraft performance and flexibility. As Eurofighter Typhoon moves into the production phase, Industria de Turbo Propulsores (ITP) and Motoren- und Turbinen-Union Muenchen GmbH (MTU) are pursuing a research and technology acquisition project to investigate the design of a thrust vectoring nozzle system suitable for future applications of the EJ200 engine. This paper describes the work related to the engine control system carried out thus far by MTU within the ITP/MTU thrust vectoring technology program.
Author
Thrust Vector Control; Engine Control; Nozzle Efficiency

20010067718 California Inst. of Tech., Div. of Engineering and Applied Science, Pasadena, CA USA
ACTIVE CONTROL SYMPOSIUM FOR POWER SYSTEMS AND PROPULSION: TECHNICAL EVALUATION REPORT
Murray, Richard M., California Inst. of Tech., USA; Active Control Technology for Enhanced Performance Operational Capabilities of

Military Aircraft, Land Vehicles and Sea Vehicles; June 2001, pp. T3-1 - T3-6; In English; See also 20010067671; Copyright Waived; Avail: CASI; A02, Hardcopy

The major themes in the symposium were compression system instabilities and combustion system instabilities, both important limiting factors of gas turbine performance. Results were presented in the area of active control of combustion instabilities demonstrating effectiveness across scales from laboratory rigs to full scale engines and a good understanding of the modeling and control issues. The status of compression systems is somewhat behind this, primarily lacking in successful demonstrations on a full-scale engine. The tradeoffs between cost and performance are also less clear in this case. Issues that have been identified for further study include actuation systems, especially the need for high frequency, high reliability actuators, sensing systems capable of operating in high temperature and high vibration environments, and control theory, specifically proving robustness and fundamental limits for controllers which are already working in application.

Author

Actuators; Combustion; Active Control; Feedback Control

20010067719 Massachusetts Inst. of Tech., Gas Turbine Lab., Cambridge, MA USA

COMPRESSOR STABILITY AND CONTROL: REVIEW AND PRACTICAL IMPLICATIONS

Paduano, James D., Massachusetts Inst. of Tech., USA; Epstein, Alan H., Massachusetts Inst. of Tech., USA; Active Control Technology for Enhanced Performance Operational Capabilities of Military Aircraft, Land Vehicles and Sea Vehicles; June 2001, pp. 1-1 - 1-20; In English; See also 20010067671; Original contains color illustrations; Copyright Waived; Avail: CASI; A03, Hardcopy

This paper discusses developments in axial compressor stability modeling over the last several years, and related work in active control of rotating stall and surge. Several major themes have emerged during this work. One theme is the interplay between hydrodynamic perturbations in axial compressors and instability inception. The former obey linearized dynamical equations, but their resonance and instability can trigger a variety of nonlinear events leading to violent oscillations in the compressor flow. An understanding of the key physical phenomena associated with stall inception, as opposed to those governing fully developed stall or surge, is critical to alleviating stall by design means or through active control. Another theme is the utility of actuators for understanding compressor stability. Active control work has prompted the installation of high-response forcing devices in compressors; even without feedback these have yielded much new information about compressor unsteady behavior. Finally, the paper reviews the methods and prospects for using active stabilization to extend the stable operating range of compressors, improving their surge margin and thus increasing overall reliability and performance. Experiments have progressed from laboratory scale demonstrations to full-scale rig and engine tests in about a decade. Competing theories about the physical mechanisms, the difficulties associated with stabilization, and the goals and control techniques for rotating stall have led to a rich research base on which compressor stability and control technology is being built.

Author

Active Control; Stability; Stabilization; Turbocompressors; Rotating Stalls

20010067726 Ruhr Univ., Fluid Energy Machines, Bochum, Germany

THE ONSET OF AERODYNAMIC INSTABILITY IN A 3-STAGE TRANSONIC COMPRESSOR

Methling, F.-O., Ruhr Univ., Germany; Preute, R., Ruhr Univ., Germany; Stoff, H., Ruhr Univ., Germany; Grauer, F., Technische Univ., Germany; Active Control Technology for Enhanced Performance Operational Capabilities of Military Aircraft, Land Vehicles and Sea Vehicles; June 2001, pp. 8-1 - 8-12; In English; See also 20010067671

Contract(s)/Grant(s): BMBF-0327041C; Copyright Waived; Avail: CASI; A03, Hardcopy

The actual research activities concerning the aerodynamic instability of compressors aim at an improvement of the usable range of the compressor performance map. Usually there must be a safety margin between operating point and stability limit to avoid stall and surge. In this paper we give a survey of the pre- and the post-instability behavior of a three-stage transonic axial aeroengine compressor. The measurement results of fluctuations of static and total pressure, temperature, and velocity under the influence of stall and surge are presented. For that were used piezo-resistive transducers, cold wires, and triple-split-film sensors. The pressure signals show that the investigated compressor flow goes into instability by a spike-type stall. The rotating stall frequency corresponds to nearly half of the shaft speed. The stall cell spreads at once over all three stages of the compressor and, after an oscillation at the beginning, extends approximately over a range of 1/3 to 1/2 of the circumference. Depending on the shaft speed different forms of instability occur like rotating stall, classic surge (local backflow) and deep surge (complete flow reversal). In the second part of this paper we analyze results using fast fourier transform and artificial neural networks. It is shown, that by using the fast fourier transform peripheral disturbances can be identified, but that an artificial neural network is the most useful tool to indicate an approaching instability in case of spike-type stalling.

Author

Aerodynamic Stability; Transonic Compressors; Aerodynamic Stalling

20010067727 Technische Univ., Inst. for Turbomachinery, Hanover, Germany

DEVELOPMENT OF FLOW INSTABILITY AND ROTATING STALL IN A MULTI-STAGE AXIAL COMPRESSOR WITH VARIABLE GUIDE-VANES

Riess, W., Technische Univ., Germany; Walbaum, M., Technische Univ., Germany; Active Control Technology for Enhanced Performance Operational Capabilities of Military Aircraft, Land Vehicles and Sea Vehicles; June 2001, pp. 9-1 - 9-16; In English; See also 20010067671; Copyright Waived; Avail: CASI; A03, Hardcopy

Many well-known investigations on flow instabilities of axial compressors have been conducted in low-speed research machines, often in a single stage configuration. It is at least not assured that the results can be transferred directly to multi-stage compressors with compressible flow, therefore measurements in machines of this type are of considerable practical interest. These machines, however, pose a lot more problems in realization, operation, and measuring techniques. They have to be of robust and elaborate design and manufacture to withstand high rotational speed and to avoid problems with blade vibrations and critical rotor speed. They need - even as model machines with reduced size - driving power of several hundred kW up to the MW range, preferably with variable speed.

Author

Flow Stability; Rotating Stalls; Turbocompressors

20010067728 Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese, Belgium

PERSPECTIVES OF PHASE-PORTRAITS IN THE DETECTION OF COMPRESSOR INSTABILITIES: INCEPTION OF STALL

DIschia, M., Von Karman Inst. for Fluid Dynamics, Belgium; Breugelmans, F. A. E., Von Karman Inst. for Fluid Dynamics, Belgium; Active Control Technology for Enhanced Performance Operational Capabilities of Military Aircraft, Land Vehicles and Sea Vehicles; June 2001, pp. 10-1 - 10-12; In English; See also 20010067671; Copyright Waived; Avail: CASI; A03, Hardcopy

The operative range of axial-flow compressors is limited by the onset of instabilities, namely rotating stall and surge that arise when the mass flow is reduced at constant rotational speed. The difficulties in correctly predicting the point of stall onset have made it necessary to establish a limit line on the performance map that cuts out operative points of high efficiencies. The particular behavior of this non-linear complex-but-structured phenomenon has suggested a scientific approach with the tools of Chaos theory. The result given by the Phase-Space reconstruction from experimental time series has suggested the possibility of applying this technique, not only to characterize the system's dynamics, but also for monitoring purposes. The experiments have been planned to capture the transition from clean flow to stalled conditions. The Phase-Portrait of the different types of stall is presented. The results from the different sensors are compared and an indicator for stall inception detection presented.

Author

Rotating Stalls; Turbocompressors; Aerodynamic Stability

20010067729 Georgia Inst. of Tech., School of Aerospace Engineering, Atlanta, GA USA
ACTIVE CONTROL OF COMPRESSOR SURGE USING A REAL TIME OBSERVER
Prasad, J. V. R., Georgia Inst. of Tech., USA; Neumeier, Yedidia, Georgia Inst. of Tech., USA; Krichene, Assaad, Georgia Inst. of Tech., USA; Active Control Technology for Enhanced Performance Operational Capabilities of Military Aircraft, Land Vehicles and Sea Vehicles; June 2001, pp. 11-1 - 11-10; In English; See also 20010067671; Original contains color illustrations
Contract(s)/Grant(s): DAAH04-96-1-0008; Copyright Waived; Avail: CASI; A02, Hardcopy

Approaches for active control of surge in axial and centrifugal compressors are based, for their majority, on sensing them after they occur and then taking appropriate action. On the other hand, some studies in the past have showed that precursors to surge exist in some cases. But very few studies have actually made use of precursors for active control. In this paper we show experimentally that surge precursors exist in centrifugal compressors. Further, we formulate a novel control scheme in which a real time observer is used for on-line identification of magnitude and frequency of dominant precursor waves. The observer outputs feed into a fuzzy logic control scheme, and the identified frequency and amplitude of the precursors are used to actuate a bleed valve and/or a fuel valve for active control of compressor surge. Experimental results demonstrating the viability of the overall scheme are presented.
Author
Active Control; Centrifugal Compressors; Surges; Turbocompressors

20010067730 Kulite Semi-Conductor Products, Inc., Leonia, NJ USA
SENSOR REQUIREMENTS FOR ACTIVE GAS TURBINE ENGINE CONTROL
Kurtz, A. D., Kulite Semi-Conductor Products, Inc., USA; Chivers, J. W. H., Kulite Semi-Conductor Products, Inc., USA; Ned, A. A., Kulite Semi-Conductor Products, Inc., USA; Epstein, A. H., Massachusetts Inst. of Tech., USA; Active Control Technology for Enhanced Performance Operational Capabilities of Military Aircraft, Land Vehicles and Sea Vehicles; June 2001, pp. 12-1 - 12-11; In English; See also 20010067671; Copyright Waived; Avail: CASI; A03, Hardcopy

This paper considers the potential benefits of active gas turbine engine control and briefly reviews a selection of the published material in the fields of detection and control of stall in axial flow turbomachines, from the perspective of an instrumentation engineer. The use of a variety of sensors and mechanical installations is discussed and a specification for a pressure sensor which can be used to detect gas path instabilities in axial flow compressors is developed. Recent developments of Silicon-On-Insulator (SOI) piezoresistive pressure sensors for gas turbine research and development and basic aerodynamic research are described in this paper. Problems which can arise from use of these sensors in ultra harsh environments are discussed. The design of a new miniature dynamic pressure transducer capable of operating reliably under extreme environmental conditions - temperatures in excess of 480 C (900 F) and accelerations greater than 200g - is described in detail. The performance of such 'leadless' pressure transducers is presented and indicates that ruggedized, high frequency, piezoresistive transducers are now feasible for use in the dynamic control of turbomachines.
Author
Active Control; Pressure Sensors; Turbocompressors; Engine Control; Aerodynamic Stalling

20010067731 Polish Air Force Inst. of Tech., Warsaw, Poland
AEROENGINE CONDITION MONITORING SYSTEM BASED ON NON-INTERFERENCE DISCRETE-PHASE COMPRESSOR BLADE VIBRATION MEASURING METHOD
Szczepanik, Ryszard, Polish Air Force Inst. of Tech., Poland; Witos, Miroslaw, Polish Air Force Inst. of Tech., Poland; Active Control Technology for Enhanced Performance Operational Capabilities of Military Aircraft, Land Vehicles and Sea Vehicles; June 2001, pp. 13-1 - 13-6; In English; See also 20010067671; Copyright Waived; Avail: CASI; A02, Hardcopy

There are many different technical engine failures we can face in turbine engine life and exploitation process. The rotor blade fatigue cracks propagation and as a consequence the blade breakaway, the excessive main engine fuel supply and bearing system getting out of order always as a rule cause a formidable danger for flight safety, engine life, and reliability. A detailed analysis each of the engine faults that occurred during the last years in Polish Air force units showed that: (1) there were some cases of fatigue blade breakaway in spite of an earlier check using blade ultrasonic and eddy current defectoscopy and technology; (2) there were some cases of bearing system damages in spite of complying with engine maintenance technical requirements; and (3) the engine fuel system getting out of order was observed as a result of fuel aggregates dynamic characteristics failure of their components as well as exploitation adjustment activities faults caused by deficient adjustment technology or methodology. Based on above there is of utmost interest the need of looking for new method to recognize stochastic loads during engine operation, their influence on structural engine reliability, and running engine technical condition. These methods should comply with present aviation trends, i.e., should reduce the number and minimize the weight of control devices as well as reduce the quantity of measured parameters. The paper presents non-interference technique of turbomachine blade vibration phase method, one of the most interesting such complex jet engine diagnostic method as well as the tool for dynamic phenomena investigation of a running engine. The method is based on discrete blade vibration amplitude measurement and its numerical response analysis referred to the jet engine technical condition analysis. The described method is used in some units of Polish Air Force as SNDL-lb/SPL-2b SO-3 jet engine diagnostic system. This engine powers polish TS-11 Iskra training aircraft.
Author
Turbine Engines; Compressor Blades; Vibration Measurement; Engine Failure

20010067732 Genoa Univ., Dipt. di Macchine, Sistemi Energetici e Trasporti, Genoa, Italy
A GAS TURBINE COMPRESSOR SIMULATION MODEL FOR INCLUSION OF ACTIVE CONTROL STRATEGIES
Cravero, Carlo, Genoa Univ., Italy; Massardo, Aristide, Genoa Univ., Italy; Active Control Technology for Enhanced Performance Operational Capabilities of Military Aircraft, Land Vehicles and Sea Vehicles; June 2001, pp. 14-1 - 14-7; In English; See also 20010067671
Contract(s)/Grant(s): CNR-99.02048; Copyright Waived; Avail: CASI; A02, Hardcopy

A one dimensional time-marching model to solve the dynamic behavior of a compression system is presented. The computational method is described in some detail and it is applied to a three-stage axial compressor with different plenum configurations. This computational model for the simulation of a multistage axial compressor is used to investigate the insertion of an active control system.
Author
Active Control; Dynamic Characteristics; Turbocompressors; Computerized Simulation

20010067733 Udine Univ., Dipt. di Energetica e Macchine, Italy
ACTIVE CONTROL OF SURGE IN COMPRESSORS WHICH EXHIBIT ABRUPT STALL
Giannattasio, P., Udine Univ., Italy; Micheli, D., Trieste Univ., Italy; Pinamonti, P., Udine Univ., Italy; Active Control Technology for Enhanced Performance Operational Capabilities of Military Aircraft, Land Vehicles and Sea Vehicles; June 2001, pp. 15-1 - 15-11; In English; See also 20010067671; Original contains color illustrations; Copyright Waived; Avail: CASI; A03, Hardcopy

The present paper reports a study on the dynamic behavior of a compression system based on a multi-stage centrifugal blower and provided with a device for the active suppression of surge instability. The control device includes a sensor of total pressure at the compressor inlet, a proportional-derivative controller, and an actuation valve at the plenum exit. A non-linear lumped-parameter model of the controlled compression system is presented, which considers also the time-lags in the compressor and actuator unsteady responses. The numerical simulation shows that: (1) the predictions of control effectiveness provided by the non-linear model are rather different from the estimates of a linear approach, mainly due to the abrupt stall which affects the compressor characteristics; (2) the present control device is capable of suppressing surge within almost the whole unstable operating range of the compressor, with values of the proportional gain small enough to avoid actuator saturation

(stroke-end occurrence); (3) the derivative component of the control law exerts a poor influence on the system stabilization and can be thus removed; and (4) the proposed control strategy is effective over a wide range of stability parameter, which implies the possibility of suppressing surge also at the highest compressor speeds and when using large plenum volumes. On the basis of the numerical results, a practical control device has been designed, which consists of a transducer of differential pressure between plenum and compressor exit (equivalent to a sensor of compressor face total pressure), a butterfly throttle/actuation valve driven by a stepper motor and a computer, provided with proper interfaces, for signal acquisition, data processing, and motor control. The device has been installed in an industrial-size compression system and an exhaustive set of measurements has been planned in order to verify the effectiveness of the proposed control strategy and to validate the theoretical model.
Author
Active Control; Surges; Compressors; Computerized Simulation; Aerodynamic Stability

20010067734 Technische Univ., Gas Turbine and Flight Propulsion, Darmstadt, Germany
ACTIVE STALL AVOIDANCE OF AN AXIAL COMPRESSOR STAGE
Wagner, S., Technische Univ., Germany; Hennecke, D. K., Technische Univ., Germany; Active Control Technology for Enhanced Performance Operational Capabilities of Military Aircraft, Land Vehicles and Sea Vehicles; June 2001, pp. 16-1 - 16-9; In English; See also 20010067671; Original contains color illustrations; Copyright Waived; Avail: CASI; A02, Hardcopy

An active stall avoidance system was designed comprising a stall recovery controller, a nonlinear compressor operating point controller and a scheme for switching between these two. Different control schemes with respect to stall removal and switching have been developed and implemented on a real-time computer. The system's capability of successful stabilization of a stalled compressor with respect to performance loss was demonstrated by several experiments conducted on a low-speed axial compressor stage. The experiments were analyzed in detail and governing parameters of stall recovery and performance are identified. Finally, improvements for the control scheme are suggested.
Author
Controllers; Stabilization; Aerodynamic Stalling; Recoverability; Turbocompressors

20010067735 Academy of Sciences (USSR), Inst. of Hydromechanics, Kiev, USSR
OPTIMIZATION OF A TURBINE BLADE PERFORMANCE DUE TO ACTIVE CONTROL OF THE VORTEX DYNAMICS
Yurchenko, N., Academy of Sciences (USSR), USSR; Rivir, R., Air Force Research Lab., USA; Active Control Technology for Enhanced Performance Operational Capabilities of Military Aircraft, Land Vehicles and Sea Vehicles; June 2001, pp. 17-1 - 17-8; In English; See also 20010067671
Contract(s)/Grant(s): F61775-99-W-E075; Copyright Waived; Avail: CASI; A02, Hardcopy

Geometry and thermal stratification of the flow around a turbine blade specify this flow as one affected by buoyancy and centrifugal forces. An approach is proposed and tested of a boundary-layer control under body forces using generation of counter-rotating streamwise vortices that are an inherent vortical structure of such flows. The active mode of vortex generation is realized due to an imposed surface temperature gradient periodic in the spanwise direction, which must be correlated with basic flow parameters. Values of two independent variables, temperature gradient and spanwise scale of induced vortices, can be adjusted to current flow conditions thus changing the vortex dynamics in a favorable way. Velocity fields and spectrum redistribution in boundary layers with embedded streamwise vortices show efficiency and prospects of the proposed method to control flow characteristics.
Author
Active Control; Boundary Layer Control; Turbine Blades; Vortices; Optimization

20010067736 Air Force Research Lab., Turbine Engine Div., Wright-Patterson AFB, OH USA
PREDICTION OF COMBUSTION-DRIVEN DYNAMIC INSTABILITY FOR HIGH PERFORMANCE GAS TURBINE COMBUSTORS, PART 1
Sekar, B., Air Force Research Lab., USA; Mawid, M. A., Engineering Research and Analysis Co., USA; Park, T. W., Engineering Research and Analysis Co., USA; Menon, S., Georgia Inst. of Tech., USA; Active Control Technology for Enhanced Performance Operational Capabilities of Military Aircraft, Land Vehicles and Sea Vehicles; June 2001, pp. 19-1 - 19-16; In English; See also 20010067671; Copyright Waived; Avail: CASI; A03, Hardcopy

This paper describes the development and application of a combined detailed three-dimensional large eddy simulation (LES) and one-dimensional analysis tool to predict and actively control combustion-driven dynamic instabilities in gas turbine combustors. The integration of detailed finite-rate kinetics into LES and use of In-situ Adaptive Tabulation (ISAT) to efficiently calculate multi-species finite-rate kinetics in LES along with the use of global kinetics in the one-dimensional analysis tool was demonstrated. The results showed that LES can be effectively used to simulate complex reacting flows in gas turbine combustors and to identify regions of combustion instabilities. The results also showed that the one-dimensional combustor analysis with global kinetics can then be used both to capture the combustor unstable modes of the predicted regions of instabilities and to actively control these instabilities. In particular, the results demonstrated that by modulating the primary fuel injection rates and the time-lag between the instant of fuel-air mixture injection and heat release, damping out the instabilities may be achieved.
Author
Combustion Chambers; Gas Turbines; Combustion Stability; Three Dimensional Models; Large Eddy Simulation

20010067748 ALSTOM Power Ltd., Baden-Daettwil, Switzerland
PERFORMANCE ENHANCEMENT OF GAS-TURBINE COMBUSTOR BY ACTIVE CONTROL OF FUEL INJECTION AND MIXING PROCESS: THEORY AND PRACTICE
Paschereit, Christian Oliver, ALSTOM Power Ltd., Switzerland; Gutmark, Ephraim, Cincinnati Univ., USA; Schuermans, Bruno, ALSTOM Power Ltd., Switzerland; Active Control Technology for Enhanced Performance Operational Capabilities of Military Aircraft, Land Vehicles and Sea Vehicles; June 2001, pp. 32-1 - 32-9; In English; See also 20010067671; Original contains color illustrations; Copyright Waived; Avail: CASI; A02, Hardcopy

Unstable thermoacoustic modes were investigated and controlled in an experimental low-emission swirl stabilized combustor, in which the acoustic boundary conditions were modified to obtain combustion instability. Axisymmetric and helical unstable modes were identified for fully premixed combustion. These unstable modes were associated with flow instabilities related to the recirculation region on the combustor axis and shear layer instabilities at the sudden expansion (dump plane). The combustion structure associated with the different unstable mode was visualized by phase locked images of OH chemiluminescence. The axisymmetric mode showed large variation of the heat release during one cycle, while the helical modes showed circumferential variations in the location of maximal heat release. Two feedback control methods employed to suppress thermoacoustic pressure oscillations and to reduce emissions are reviewed: proportional acoustic control and fuel modulations. Microphone sensors monitored the combustion process and provided input to the control systems. An acoustic actuation modulated the airflow and thus affected the mixing process and the combustion. Suppression levels of up to 25 dB in the pressure oscillations and at concomitant 10% reduction of NOx emissions were obtained. At the optimal control conditions it was shown that the major effect of the control system was to reduce the coherence of the vortical structures which gave rise to the thermoacoustic instability. The specific design of the investigated experimental burner allowed testing the effect of different modulated fuel injection concepts on the combustion instability modes. Symmetric and antisymmetric fuel injection schemes were tested. Suppression levels of up to 12 dB in the pressure oscillations were observed. In some cases concomitant reductions of NOx and CO emissions were obtained. Open loop control of low frequency symmetric instability by secondary fuel injection in a pilot flame reduced the pressure oscillations by up to 20 dB.
Author
Active Control; Fuel Injection; Combustion Stability; Pressure Oscillations

20010067749 California Univ., Combustion Lab., Irvine, CA USA
ACTIVE OPTIMISATION OF THE PERFORMANCE OF GAS TURBINE COMBUSTOR
Miyasato, M. M., California Univ., USA; McDonell, V. G., California Univ., USA; Samuelsen, G. S., California Univ., USA; Active Control Technology for Enhanced Performance Operational Capabilities of Military Aircraft, Land Vehicles and Sea Vehicles; June 2001, pp. 33-1 - 33-9; In English; See also 20010067671; Original contains color illustrations; Sponsored in part by California Inst. for Energy Efficiency; Copyright Waived; Avail: CASI; A02, Hardcopy

The increasingly stringent regulation of gas turbine exhaust emissions, combined with the need to reduce overall cost of operation, is requiring advancements to be made in the combustion system. In particular, the ability of these systems to attain both low emissions and high efficiency over increasingly longer periods of operation, in order to reduce maintenance costs, is requiring new thinking with respect to the system control strategies. This new thinking is further necessitated by operation of these devices at conditions that are prone to combustion instabilities. As a result, development of a gas turbine that can actively respond to changes in load, system wear, and/or fuel composition, while maintaining efficiency and emissions performance, would be well received. Many technological hurdles must be overcome for this to occur, including the development of sensors, control strategies, and hardware capable of 'self-tuning' or 'active optimization.' In the present study, a model natural gas-fired industrial gas turbine combustor is utilized to evaluate the performance of different active optimization strategies. Sensors for exhaust species and reaction zone chemiluminescence are utilized in conjunction with an adaptive fuel injection strategy in a closed loop control system. This system has been developed to maintain overall performance in light of environmental changes (e.g., fuel composition changes, injector wear, load changes). The feedback sensor consists of traditional extractive probe based exhaust measurements of major species including carbon monoxide and oxides of nitrogen. This sensor is utilized to provide direct measurement of emissions performance in terms of CO and NOx emissions. Chemiluminescence is utilized to evaluate the ability of inferential methods to provide very fast, yet accurate indicators of performance. For the current study, a simulated injector perturbation scenario (partial fuel jet blockage) is utilized to examine the robustness of the different optimization strategies. And, as a first step, a direction-set algorithm is utilized to search for the region of optimal performance. The results obtained illustrate: (1) the relative correlation of the different sensor strategies with system performance, and (2) the ability of the closed loop control to maintain combustion performance in light of an unexpected hardware perturbation.
Author
Active Control; Optimization; Combustion Stability; Gas Turbines; Chemiluminescence

20010067750 Imperial Coll. of Science, Technology and Medicine, Thermofluids Section, London, UK
ACTIVE CONTROL OF OSCILLATIONS IN SIMULATIONS OF GAS-TURBINE COMBUSTORS
DeZilwa, S. R. N., Imperial Coll. of Science, Technology and Medicine, UK; Uhm, J. H., Imperial Coll. of Science, Technology and Medicine, UK; Whitelaw, J. H., Imperial Coll. of Science, Technology and Medicine, UK; Active Control Technology for Enhanced Performance Operational Capabilities of Military Aircraft, Land Vehicles and Sea Vehicles; June 2001, pp. 34-1 - 34-4; In English; See also 20010067671
Contract(s)/Grant(s): N68171-97-C-9009; Copyright Waived; Avail: CASI; A01, Hardcopy

The approach to extinction of a premixed methane-air flame stabilized behind a plane sudden-expansion gave rise to cyclic movement of the position of flame stabilization with a period of the order of 100 ms. These oscillations have been quantified in terms of simultaneous measurements of pressure and light emission, and the pressure maximum corresponded to the flame position closest to the step and the minima to that furthest away. The active control strategy of a imposing out-of-phase oscillations was unsuccessful since the period of the near-limit cycles varied over a substantial range and a new approach will be required to track the signal and to implement online actuation that will counteract the tendency for flame movement.
Author
Active Control; Oscillations; Premixed Flames; Gas Turbines

20010067753 Defence Evaluation Research Agency, Propulsion and Performance Dept., Farnborough, UK
COMBUSTION OSCILLATION IN A STAGED LPP COMBUSTOR
Austin, J. A., Defence Evaluation Research Agency, UK; Tilston, J. R., Defence Evaluation Research Agency, UK; McKenzie, I. R. I., Defence Evaluation Research Agency, UK; Active Control Technology for Enhanced Performance Operational Capabilities of Military Aircraft, Land Vehicles and Sea Vehicles; June 2001, pp. 18-1 - 18-7; In English; See also 20010067671; Original contains color illustrations
Contract(s)/Grant(s): ECC-BRPR-CT95-0122; Copyright Waived; Avail: CASI; A02, Hardcopy

The presence of combustion oscillation, caused by self amplification of the pressure and heat release fields, is very common within Lean Premixed Prevaporised (LPP) combustors. After suffering significant structural damage from oscillations of this type, an axially staged combustor was subjected to a program of diagnostic testing to establish a series of safe running conditions. Using fuel staging to vary the local air to fuel ratios (AFR), a series of conditions exhibiting much reduced levels of oscillation were identified.
Author
Combustion; Combustion Chambers; Oscillations

08
AIRCRAFT STABILITY AND CONTROL

19990032452 Army Aviation and Missile Command, Aeroflightdynamics Directorate, Moffett Field, CA USA
SYSTEM IDENTIFICATION METHODS FOR AIRCRAFT FLIGHT CONTROL DEVELOPMENT AND VALIDATION
Tischler, Mark B., Army Aviation and Missile Command, USA; System Identification for Integrated Aircraft Development and Flight Testing; March 1999, pp. 3-1 - 3-18; In English; See also 19990032449; Copyright Waived; Avail: CASI; A03, Hardcopy; A04, Microfiche

System identification methods compose a mathematical model, or series of models, from measurements of inputs and outputs of dynamic systems. The extracted models allow the characterization of the response of the overall aircraft or component subsystem behavior, such as actuators and on-board signal processing algorithms. This paper discusses the use of frequency-domain system-identification methods for the development and integration of aircraft flight-control systems. The extraction and analysis of models of varying complexity from nonparametric frequency-responses to transfer-functions and high-order state-space representations is illustrated using the Comprehensive Identification from FrEquency Responses (CIFER(R)) system-identification facility. Results are presented for test data of numerous flight and simulation programs at the Ames Research Center including rotorcraft, fixed-wing aircraft, advanced short takeoff and vertical landing (ASTOVL), vertical/short takeoff and landing (V/STOL), tiltrotor aircraft, and rotor experiments in the wind tunnel. Excellent system characterization and dynamic response prediction is achieved for this wide class of systems. Examples illustrate the role of system identification technology in providing an integrated flow of dynamic response data around the entire life-cycle of aircraft development from initial specifications, through simulation and bench testing, and into flight-test optimization.
Author
System Identification; Flight Control; Dynamic Response; Aircraft Design; Control Systems Design; Systems Engineering; Parameter Identification; Systems Integration; Frequency Domain Analysis

19990032453 Aerospatiale, Toulouse, France
IDENTIFICATION TOOLS FOR LATERAL FLIGHT MECHANICS OF AIRBUS AIRCRAFT *[OUTILS D'IDENTIFICATION DE LA MECANIQUE DU VOL LATERALE DES AIRBUS]*
Liot, D., Aerospatiale, France; Bucharies, A., Office National d'Etudes et de Recherches Aerospatiales, France; System Identification for Integrated Aircraft Development and Flight Testing; March 1999, pp. 4-1 - 4-9; In French; See also 19990032449; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

For each plane developed, AEROSPATIALE is equipped with a flight mechanics model in order to: ensure the analysis of the aircraft's flight capabilities; assist in defining and validating flight

command laws (automatic and manual); and help in training commerical aircraft company crews. This model must cover all of the aircraft's situations (normal, peripheral, failure situations, etc.) with the highest possible representativity. In practical terms it is gradually being constructed. Theoretical calculations in combination with experience gained thus far, as well as wind tunnel trials, have already allowed us to develop a provisional model which is quite satisfactory. However, the required precision can only be attained by resetting it based on the flight behavior analysis of trial aircraft. AEROSPATIALE, in collaboration with ONERA, has developed two identification tools, IDLAT_NL and COR_NL, which reset the provisional lateral aerodynamic models in linear and non-linear zones. The latter have been successfully operated during the latest Airbus programs. Transl. by Schreiber

System Identification; Flight Characteristics; European Airbus; Lateral Control; Systems Engineering; Control Systems Design

19990032463 NASA Langley Research Center, Hampton, VA USA
CLOSED-LOOP SYSTEM IDENTIFICATION EXPERIENCE FOR FLIGHT CONTROL LAW AND FLYING QUALITIES EVALUATION OF A HIGH PERFORMANCE FIGHTER AIRCRAFT

Murphy, Patrick C., NASA Langley Research Center, USA; System Identification for Integrated Aircraft Development and Flight Testing; March 1999, pp. 16-1 - 16-13; In English; See also 19990032449; Copyright Waived; Avail: CASI; A03, Hardcopy; A04, Microfiche

This paper highlights some of the results and issues associated with estimating models to evaluate control law design methods and design criteria for advanced high performance aircraft. Experimental fighter aircraft such as the NASA High Alpha Research Vehicle (HARV) have the capability to maneuver at very high angles of attack where nonlinear aerodynamics often predominate. HARV is an experimental F/A-18, configured with thrust vectoring and conformal actuated nose strakes. Identifying closed-loop models for this type of aircraft can be made difficult by nonlinearities and high-order characteristics of the system. In this paper only lateral-directional axes are considered since the lateral-directional control law was specifically designed to produce classical airplane responses normally expected with low-order, rigid-body systems. Evaluation of the control design methodology was made using low-order equivalent systems determined from flight and simulation. This allowed comparison of the closed-loop rigid-body dynamics achieved in flight with that designed in simulation. In flight, the On Board Excitation System was used to apply optimal inputs to lateral stick and pedals at five angles of attack: 5, 20, 30, 45, and 60 degrees. Data analysis and closed-loop model identification were done using frequency domain maximum likelihood. The structure of the identified models was a linear state-space model reflecting classical 4th-order airplane dynamics. Input time delays associated with the high-order controller and aircraft system were accounted for in data preprocessing. A comparison of flight estimated models with small perturbation linear design models highlighted nonlinearities in the system and indicated that the estimated closed-loop rigid-body dynamics were sensitive to input amplitudes at 20 and 30 degrees angle of attack.

Author

Parameter Identification; Aircraft Design; System Identification; Flight Tests; Feedback Control; Directional Control; Controllers; Flight Control; Research Vehicles; Thrust Vector Control

19990032476 Glasgow Univ., Dept. of Aerospace Engineering, UK
IDENTIFICATION OF GYROPLANE STABILITY AND CONTROL CHARACTERISTICS

Houston, S., Glasgow Univ., UK; Thomson, D., Glasgow Univ., UK; System Identification for Integrated Aircraft Development and Flight Testing; March 1999, pp. 31-1 - 31-11; In English; See also 19990032449

Contract(s)/Grant(s): CAA-7D/S/1125; Copyright Waived; Avail: CASI; A03, Hardcopy; A04, Microfiche

This paper presents an analysis of test data recorded during flight trials of a gyroplane. This class of rotary-wing aircraft has found limited application in areas other than sport or recreational flying. However, the accident rate is such that a study of the configuration's stability and control characteristics is timely, and in addition substantive data is required for a new airworthiness and design standard that is under development. The paper discusses the special nature of the application of system identification tools to the gyroplane problem, particularly in the context of lack of a priori knowledge of the type's dynamic characteristics, design of installation and experiments, and data analysis.

Author

System Identification; Helicopters; Helicopter Control; Gyroscopic Stability; Control Systems Design; Parameter Identification; Frequency Domain Analysis

19990053154 Office National d'Etudes et de Recherches Aerospatiales, Dept. Commande des Syst mes et Dynamique, Toulouse, France
PILOTING OF A VTOL-UAV TO SHIPBOARD RECOVERY

Reboulet, C., Office National d'Etudes et de Recherches Aerospatiales, France; Mouyon, P., Office National d'Etudes et de Recherches Aerospatiales, France; deFerrier, Bernard, Bombardier Services Corp., USA; Langlois, Bernard, Bombardier, Inc., Canada; Fluid Dynamics Problems of Vehicles Operating Near or in the Air-Sea Interface; February 1999, pp. 11-1 - 11-6; In English; See also 19990053143; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

A system of guidance and control ensuring the safe recovery of a VTOL type unmanned air vehicle is described. The key ideas of the proposed approach are the estimation of the velocity/position with respect to the ship in a quasi-inertial coordinate frame and the guidance/control of the air vehicle to a virtual target (predicted position of the landing grid). The advantage of this guidance and control approach is the complete decoupling of the UAV from ship motions. The various methods used in each module of the whole recovery system are presented, including: tracking, filtering, and landing deck position prediction. Model performances based on test results are discussed. Strategy chosen in the development of the whole automated recovery system is described. Finally, an assessment of the proposed concept obtained by simulation is provided. These results show that this approach is more robust than conventional motion sensitive techniques. The system promises to dramatically increase UAV operational limits and recovery efficiency. This activity is sponsored by the Delegation Generale de l'Armement (DGA France) and was accomplished with the framework of a Franco- Canadian collaborative project between ONERA-DCSD and Bombardier, Inc (Canadair).

Author

Pilotless Aircraft; Remotely Piloted Vehicles; Vertical Takeoff Aircraft; Vatol Aircraft; Autonomous Navigation; Automatic Flight Control; Aircraft Control

19990053157 Delegation Generale de l'Armement, Surface Ship Dept., Paris, France
HEEL COMPENSATION FOR THE CHARLES DE GAULLE AIRCRAFT CARRIER: PRINCIPLES AND CONTROL STRUCTURE

Kummer, S., Delegation Generale de l'Armement, France; Hardier, G., Office National d'Etudes et de Recherches Aerospatiales, France; Fluid Dynamics Problems of Vehicles Operating Near or in the Air-Sea Interface; February 1999, pp. 14-1 - 14-10; In English; See also 19990053143; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

To improve the sea keeping performances of the french nuclear aircraft carrier Charles de Gaulle, with respect to its predecessors Clemenceau and Foch, DCN has developed a platform motion control system, called SATRAP, which reduced the ship motions while ensuring navigation capability. This system involves a centralized computer which controls three subsystems: two pairs of stabilizing fins, a set of rudders and a moving-mass system (athwart ship) for heel compensation, the Cogite system. Originally conceived for situations where the stabilizing fins would be otherwise saturated (steady heel from wind or heavy weights displacements). Cogite has evolved into a system which also improves the operational capability of the ship by limiting the heel during sharp turns, permitting non-stop handling and preparation of aircrafts. This paper presents the results of the studies which led to the development of a performing mode of operation for SATRAP, where the helmsman has full control of the rudders while the fins and Cogite system automatically reduce the ship motions. The following points are discussed in this paper: operational requirements in terms of performances, SATRAP system architecture and principles chosen for the control laws (task allocation for the actuators, feedforward-feedback controllers).

Author

Aircraft Carriers; Control Theory; Control Systems Design; Feedback Control; Feedforward Control; Stabilization

19990053163 Academy of Sciences of the Ukraine, Inst. of Hydromechanics, Kiev, Ukraine

LONGITUDINAL STABILITY OF EKRANOPLANS AND HYDROFOILS SHIPS

Korolyov, V. I., Academy of Sciences of the Ukraine, Ukraine; Fluid Dynamics Problems of Vehicles Operating Near or in the Air-Sea Interface; February 1999, pp. 20-1 - 20-8; In English; See also 19990053143; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

Longitudinal stability of ekranoplans and hydrofoil ships, that have two carrying hydrofoils separated by some distance along the length of hull, 'tandem' system, is considered in the paper. Longitudinal stability is characterized by the value of metacentric height, which is used in the practice of ship-building. An expression is given for the definition of this value depending on the main geometric and aerodynamic parameters. A link is determined between the metacentric height and frequency of the free angular movements of ekranoplans. A parameter investigation is fulfilled and recommendations are obtained for the choice of combinations of the carrying system basic elements.

Author

Hydrofoils; Hydrofoil Craft; Hydroplanes (Vehicles); Longitudinal Stability; Hydrodynamics

20000037837 Turkish Aerospace Industries, Avionics Group, Ankara, Turkey

FLIGHT CONTROL LAW DESIGN AND HIL SIMULATION OF A UAV

Ulku, A., Turkish Aerospace Industries, Turkey; Advances in Vehicle Systems Concepts and Integration; April 2000, pp. B17-1 - B17-6; In English; See also 20000037804; Copyright Waived; Avail: CASI; A02, Hardcopy

An adaptive control methodology, merging two known approaches to flight control problem, gain-scheduling and direct eigenspace assignment (DEA), is developed. A gain-scheduled inner (stability) loop structure is shown to minimize the variance of the outer (guidance) loop gains and increase the robustness of the system. The employment of DEA with gain scheduling is observed to decouple the longitudinal and lateral flight modes resulting adequate system stability, enhanced robustness and control surface effectiveness. This methodology is used in the flight control law design of a UAV.

Derived from text

Adaptive Control; Flight Control; Hardware-In-The-Loop Simulation; Pilotless Aircraft; Control Systems Design

20000037838 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

UNMANNED RESEARCH VEHICLE (URV): DEVELOPMENT, IMPLEMENTATION, AND FLIGHT TEST OF A MIMO DIGITAL FLIGHT CONTROL SYSTEM DESIGNED USING QUANTITATIVE FEEDBACK THEORY

Houpis, C. H., Air Force Inst. of Tech., USA; Rasmussen, S. J., Air Force Inst. of Tech., USA; Advances in Vehicle Systems Concepts and Integration; April 2000, pp. B18-1 - B18-12; In English; See also 20000037804; Copyright Waived; Avail: CASI; A03, Hardcopy

The Quantitative Feedback Theory (QFT) design technique, which has the ability to bridge the gap between theory and the real-world control design problem, is utilized in the design of a MIMO digital flight control system for an unmanned research vehicle (URV) that is presented in this paper. The design illustrates how the real-world knowledge of the plant to be controlled and the desired performance specifications can be utilized in trying to achieve a successful robust design for a nonlinear control problem. This paper presents some of the issues involved in developing, implementing, and flight testing a flight control system (FCS) designed using QFT. Achieving a successful FCS involves a number of steps: specification of the control problem, aircraft model data, theoretical flight control system design, implementation, ground testing, and flight test. The last three steps embody the practical engineering aspects that are vital to achieving a successful FCS. The main emphasis of this paper is on these steps, First, there is a brief explanation of the MIMO design QFT process. This is followed by a description of the steps involved in the implementation and testing of a QFT designed FCS. Thus, this presentation provides an overview of using robust control system design to increase quality in attempting to demonstrate the Bridging the Gap between control theory and the realities of a successful control system design. In facing the technological problems of the future. it is necessary that engineers of the future must be able to bridge the gap, i.e., this Bridging the Gap must be addressed to better prepare the engineers for the 21st century.

Author

Control Systems Design; Flight Tests; Mimo (Control Systems); Research Vehicles; Pilotless Aircraft; Feedback

20000053161 Daimler-Benz Aerospace A.G., Military Aircraft Div., Munich, Germany

THE INTERACTION OF FLIGHT CONTROL SYSTEM AND AIRCRAFT STRUCTURE

Becker, J., Daimler-Benz Aerospace A.G., Germany; Caldwell, B., British Aerospace Aircraft Group, UK; Vaccaro, V., Alenia Aeronautica, Italy; Structural Aspects of Flexible Aircraft Control; May 2000, pp. 4-1 - 4-11; In English; See also 20000053157; Copyright Waived; Avail: CASI; A03, Hardcopy

Results from structural coupling investigations are presented which include the design and verification of structural filters for a flight control system. The advantages of an integrated interdisciplinary flight control system (FCS) design on the basis of the coupled dynamic model of the structural dynamic model and the flight dynamic model of the aircraft are described. The design strategy of the Flight Control System development is improved through the integrated design optimisation procedure which includes the modelling of the coupled system of the flight dynamics, the structural dynamics, the actuators and sensors as well as the effects of the digital system. Different examples are demonstrated which document the advantages of the integrated, interdisciplinary design. Methods to avoid structural mode-flight interaction are described. Especially the design of filters to minimise interaction is outlined, which is based upon a model of the aircraft describing the coupled flight dynamic flight control dynamics and structural dynamic behaviour and on ground and in flight structural coupling tests. The paper explains design procedures, design and clearance requirements, correlation between model predictions and structural coupling tests and model update for on ground and in flight.

Author

Control Systems Design; Dynamic Characteristics; Dynamic Models; Dynamic Structural Analysis; Flight Control; Optimization; Aircraft Structures

20000053166 Dassault Aviation, Saint-Cloud, France

FLUTTER ANALYSIS METHOD IN PRESENCE OF MECHANICAL PLAY AND EXPERIMENTAL VERIFICATION *[METHODE DE CALCUL DU FLUTTER EN PRESENCE DE JEU MECANIQUE ET VERIFICATION EXPERIMENTALE]*

Petiau, C., Dassault Aviation, France; Journee, B., Dassault Aviation, France; Garrigues, E., Dassault Aviation, France; Structural Aspects of Flexible Aircraft Control; May 2000, pp. 9-1 - 9-16; In French; See also 20000053157; Copyright Waived; Avail: CASI; A03, Hardcopy

Flutter analysis in presence of mechanical play occurs in the certification of fail-safe linkage of Falcon horizontal stabilizer. The corresponding calculation method has been developed in our ELFINI software, if is based on: a Finite Element Structural dynamics model, a time domain model of unsteady aerodynamics (Karpel type), an implicit time integration, and the resolution of play/contact by an algorithm derived from quadratic optimization techniques. We expose the experimental verification methodology with dynamic model in wind tunnel, in 3 steps: definition, preliminary calculations, sizing of experience for checking observability of studied phenomena, verification, calibration of structural F.E. model with static and vibration tests, of aerodynamic model with steady and unsteady pressure measurements, comparison of calculated/measured critical flutter speeds with fixed contact, flutter calculation calibrated structural and aerodynamic models, the simulation reproduces test results both qualitatively (damped behaviour, limit cycles, divergence) and quantitatively (acceleration levels).

Author

Dynamic Models; Dynamic Response; Dynamic Structural Analysis; Finite Element Method; Flutter Analysis; Mathematical Models; Flight Simulation; Aircraft Design

20000053167 Aerospatiale Matra Airbus, Toulouse, France
AN INTEGRATED PROCESS FOR DESIGN AND VALIDATION OF FLIGHT CONTROL LAWS OF FLEXIBLE AIRCRAFT STRUCTURE
Lacabanne, Michel, Aerospatiale Matra Airbus, France; Humbert, Marc, Aerospatiale Matra Airbus, France; Structural Aspects of Flexible Aircraft Control; May 2000, pp. 9bis-1 - 9bis-6; In English; See also 20000053157; Copyright Waived; Avail: CASI; A02, Hardcopy

This paper recalls some problems which need to be carefully studied in relation with flexibility of large transport aircraft and control laws design. The evolution of flexible aircraft models is described, and it is shown that the evolution of the Flight Control System (FCS) design process is coming along with more interdisciplinary models. The FCS validation process is supported by models, and by flight tests. The need to perform an in flight identification of structural modes is explained, as well as the methodology which could be used for future very large transport aircraft.
Author
Control Systems Design; Flight Control; Very Large Transport Aircraft; Aeroservoelasticity; Aircraft Structures; Systems Integration; Dynamic Models

20000053173 NASA Langley Research Center, Hampton, VA USA
NASA LANGLEY RESEARCH CENTER'S CONTRIBUTIONS TO INTERNATIONAL ACTIVE BUFFETING ALLEVIATION PROGRAMS
Moses, Robert W., NASA Langley Research Center, USA; Structural Aspects of Flexible Aircraft Control; May 2000, pp. 15-1 - 15-9; In English; See also 20000053157; Copyright Waived; Avail: CASI; A02, Hardcopy

Buffeting is an aeroelastic phenomenon which plagues high performance aircraft, especially those with twin vertical tails like the F/A-18, at high angles of attack. This buffeting is a concern from fatigue and inspection points of view. By means of wind-tunnel and flight tests, this phenomenon is well studied to the point that buffet loads can be estimated and fatigue life can be increased by structural enhancements to the airframe. In more recent years, buffeting alleviation through active control of smart materials has been highly researched in wind-tunnel proof-of-concept demonstrations and full-scale ground tests using the F/A-18 as a test bed. Because the F/A-18 resides in fleets outside as well as inside the USA, these tests have evolved into international collaborative research activities with Australia and Canada, coordinated by the Air Force Research Laboratory (AFRL) and conducted under the auspices of The Technical Cooperation Program (TTCP). With the recent successes and advances in smart materials, the main focus of these buffeting alleviation tests has also evolved to a new level: utilize the F/A-18 as a prototype to mature smart materials for suppressing vibrations of aerospace structures. The role of the NASA Langley Research Center (LaRC) in these programs is presented.
Author
Active Control; Aeroelasticity; Aircraft Structures; Buffeting; Smart Materials; Aerodynamic Stability; NASA Programs

20000053174 Dassault Aviation, Saint-Cloud, France
METHOD OF MATHEMATICAL IDENTIFICATION OF UNSTEADY AIRLOADS FROM FLIGHT MEASUREMENTS, EXPERIMENTAL VALIDATION *[METHODE D'IDENTIFICATION DES FORCES AERODYNAMIQUES INSTANTIONNAIRES SUR LES ESSAIS EN VOL, VALIDATION EXPERIMENTALE]*
Petiau, C., Dassault Aviation, France; Garrigues, E., Dassault Aviation, France; Nicot, Ph., Dassault Aviation, France; Structural Aspects of Flexible Aircraft Control; May 2000, pp. 16-1 - 16-8; In French; See also 20000053157; Copyright Waived; Avail: CASI; A02, Hardcopy

Since the end of the 70ies we have developed, within the frame of our ELFINI software, original techniques for mathematical model identifications, in particular for calibration of dynamic Finite Element models from ground vibration tests and of steady aeroelastic loads from flight tests. Now we have tackled calibration of unsteady airloads from flight vibration tests. Mathematically speaking, we keep the same approach, which differs notably from classical least square methods (minimization of a calculation-measurement 'distance' in function of calibration parameters). We prefer to use a quadratic optimizaton type approach with the minimization of a 'distance' between calibration parameters and their theoretical or presumed values, constraining the solution to satisfy measurement reconstitution by the model at a given accuracy. Among advantages of this technique, the principal is to get rid of ill-observable parameters. We describe two applications: (1) Calibration of steady aerodynamic pressure fields from flight measurements of strain-gage responsed in maneuver, illustrated by an example coming from the calibration of Rafale airloads; (2) Calibration of unsteady airloads from wind tunnel measurements, transposable to flight measurements, of frequencies and dampings of aeroelastic dynamic model of an Airbus type stabilizer. We show that critical flutter speed is identified from tests at much lower speed. As a conclusion we present the future prospect for the method.
Author
Parameter Identification; Calibrating; Dynamic Models; Finite Element Method; Aerodynamic Loads; Aeroelasticity

20000053176 Technische Hochschule, Inst. of Flight Mechanics and Control, Stuttgart, Germany
INTEGRATED FLIGHT MECHANIC AND AEROELASTIC MODELLING AND CONTROL OF A FLEXIBLE AIRCRAFT CONSIDERING MULTIDIMENSIONAL GUST INPUT
Teufel, Patrick, Technische Hochschule, Germany; Hanel, Martin, Technische Hochschule, Germany; Well, Klaus H., Technische Hochschule, Germany; Structural Aspects of Flexible Aircraft Control; May 2000, pp. 18-1 - 18-9; In English; See also 20000053157
Contract(s)/Grant(s): FKZ-20A9503G; Copyright Waived; Avail: CASI; A02, Hardcopy

In this paper, the influence of gusts on the dynamics of a large flexible aircraft is analyzed, and an integrated flight and aeroelastic control law that reduces gust sensitivity is presented. The calculations are based on an integrated model that includes all 1st order couplings between flight mechanic and structural degrees of freedom. Uniform, 1-dimensional and multidimensional gust models are implemented and used for gust sensitivity analysis. For the example aircraft, the differences in gust sensitivity calculated with the 1-dimensional and multi-dimensional gust models are significant. Integrated attitude, stability augmentation, and aeroelastic control laws for longitudinal and lateral motion are designed using micro-synthesis. With the control laws, flight maneuvers do not excite elastic reactions, and the sensitivity to gusts is considerably reduced.
Author
Aeroelasticity; Attitude Stability; Flight Mechanics; Stability Augmentation; Gust Loads; Control Theory; Aircraft Models

20000053177 Daimler-Benz Aerospace A.G., Bremen, Germany
INTEGRAL CONTROL OF LARGE FLEXIBLE AIRCRAFT
Koenig, Klaus, Daimler-Benz Aerospace A.G., Germany; Schuler, Joerg, Daimler-Benz Aerospace A.G., Germany; Structural Aspects of Flexible Aircraft Control; May 2000, pp. 19-1 - 19-12; In English; See also 20000053157; Copyright Waived; Avail: CASI; A03, Hardcopy

In a flexible aircraft flight control, load control and structural mode control interfere with each other. Therefore, an integral design of controller(s) is necessary. This paper describes how an integral aircraft model covering the requirements of all three disciplines can be derived and how an integral controller can be designed by multiobjective parameter optimization. General design criteria for mode control are proposed.
Author
Controllers; Flexible Wings; Flight Control; Control Systems Design; Mathematical Models; Aerodynamic Loads; Transport Aircraft

20000053178 Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Inst. for Robotics and System Dynamics, Wessling, Germany
DESIGN OF CONTROL LAWS FOR ALLEVIATION OF GROUND - INDUCED VIBRATIONS
Krueger, W. R., Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; Kortuem, W., Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; Structural Aspects of Flexible Aircraft Control; May 2000, pp. 20-1 - 20-8; In English; See also 20000053157; Copyright Waived; Avail: CASI; A02, Hardcopy

An aircraft is subject to a great number of different loads during one operational cycle. For the aircraft, not only the flight loads but also the ground loads are of importance. A crucial point is therefore

the development of airframe and landing gears in an integrated design process. Semi-active landing gears are able to effectively suppress fuselage vibrations which have been excited by an uneven runway. During the design process of such control structures the dynamics of landing gear and airframe have to be known. At the example of the control design for a semi-active damper it will be shown how existing design tools can be used for the integrated design process. The design process will be described and simulation results for aircraft with semi-active landing gears controlled by a sky-hook controller and a state feedback controller.
Author
Ground Effect (Aerodynamics); Landing Gear; Control Theory; Aerodynamic Loads; Control Systems Design; Structural Vibration; Systems Analysis

20000053182 Office National d'Etudes et de Recherches Aerospatiales, Systems Control and Flight Dynamics Dept., Toulouse, France
AN INTEGRATED METHODOLOGY FOR FLEXIBLE AIRCRAFT CONTROL DESIGN *[UNE METHODOLOGIE GLOBALE DE CONCEPTION DE LOIS DE COMMANDE POUR L'AVION SOUPLE]*
Alazard, D., Office National d'Etudes et de Recherches Aerospatiales, France; Bucharles, A., Office National d'Etudes et de Recherches Aerospatiales, France; Ferreres, G., Office National d'Etudes et de Recherches Aerospatiales, France; Magni, J. F., Office National d'Etudes et de Recherches Aerospatiales, France; Prudhomme, S., Office National d'Etudes et de Recherches Aerospatiales, France; Structural Aspects of Flexible Aircraft Control; May 2000, pp. 25-1 - 25-10; In English; See also 20000053157; Copyright Waived; Avail: CASI; A02, Hardcopy
This article details recent research activities of the Systems Control and Flight Dynamics department of ONERA in the field of flexible aircraft control. A long-term research program has been conducted for several years, with governmental funds, and with the technical support of AEROSPATIALE-Avions (Toulouse, France). Beyond the primary objectives of achieving various specifications for simultaneous aircraft motion and structural dynamics control, more fundamental questions are addressed, concerning the implications of rigid-structural dynamics coupling for the selection of suitable control law design methodologies.
Author
Aircraft Control; Control Theory; Dynamic Structural Analysis; Control Systems Design; Systems Integration

20000108803 Swedish Defence Research Establishment, Stockholm, Sweden
GUIDANCE AND CONTROL TECHNOLOGY
Technologies for Future Precision Strike Missile Systems; September 2000, pp. 3-1 - 3-10; In English; See also 20000108801; Copyright Waived; Avail: CASI; A02, Hardcopy
The fundamental ideas and the basic mathematics of the most common missile guidance laws are outlined. Rules of thumb for the required lateral acceleration for the different guidance laws are given. A brief summary of flight mechanics is given. The pitch axis control is treated and the dynamic properties are identified. Design of the autopilot for the inner loop using modem methods of controller design is briefly outlined.
Author
Missile Control; Radar Homing Missiles; Autonomous Navigation; Automatic Flight Control; Trajectory Optimization; Automatic Pilots; Dynamic Characteristics; Controllers

20010003259 Munich FAF Univ., Neubiberg, Germany
PILOT'S ASSISTANT IN TACTICAL TRANSPORT MISSIONS: CREW ASSISTANT MILITARY AIRCRAFT CAMA
Lenz, Andreas, Munich FAF Univ., Germany; Onken, Reiner, Munich FAF Univ., Germany; Usability of Information in Battle Management Operations; November 2000, pp. 16-1 - 16-7; In English; See also 20010003245; Copyright Waived; Avail: CASI; A02, Hardcopy
New information technology promises more information and advanced automated functions in future cockpits of military aircraft. However the cognitive human capabilities stay the same. This may result in an overload of the human pilot. Cognitive assistant systems are being developed to compensate for this mismatch. This paper introduces principles of cognitive systems which exhibit human-like capabilities as interpretation and diagnosis of the situation, planning and decision making. Furthermore, CAMA (Crew Assistant Military Aircraft), a prototype of a cognitive assistant system, will be introduced. CAM functionality will be shown and some results from flight simulator test runs will be presented.
Author
Human Performance; Mental Performance; Information Management; Military Technology; Technology Assessment

20010003264 Institut de Medicine Aerospatiale Armee, Bretigny sur Orge, France
WHICH ASSISTANCE FOR THE MANAGEMENT OF THE TACTICAL MISSIONS? IN CONNECTION WITH COPILOT PROJECT ELECTRONIC *[QUELLE ASSISTANCE POUR LA GESTION DES MISSIONS TACTIQUES? A PROPOS DU PROJECT COPILOTE ELECTRONIQUE]*
Grau, J. Y., Institut de Medicine Aerospatiale Armee, France; Hourlier, S., Institut de Medicine Aerospatiale Armee, France; Amalberti, R., Institut de Medicine Aerospatiale Armee, France; Usability of Information in Battle Management Operations; November 2000, pp. 22-1 - 22-8; In French; See also 20010003245; Copyright Waived; Avail: CASI; A02, Hardcopy
Aircraft automation has forced designers to enhance their systems with aids to keep the pilot 'in the loop'. The development of assistance systems are in line with the evolution of 'human factor' knowledge. Drawing from the concept of human-centered design, we introduce new assistance systems based upon Man-Machine-Environment interactions. Applied to fighter aircraft, these concepts gave birth to the 'Electronic Copilot' program. The Electronic Copilot is a cooperative aid. It is aimed at helping the pilot operate at his best cognitive compromise. The philosophy and the Electronic Copilot program itself are described in the paper. The last part is dedicated to the lessons to be drawn from the program. Beyond any technical issues and the challenge of designing with Knowledge based systems and Artificial Intelligence technology, the assistance principles evaluated in this study appear to be promising if humans are ever to stay in the loop of complex system control.
Author
Knowledge Based Systems; Man Machine Systems; Military Technology; Human Performance

20010009846 NASA Langley Research Center, Hampton, VA USA
TEST CASES FOR FLUTTER OF THE BENCHMARK MODELS RECTANGULAR WINGS ON THE PITCH AND PLUNGE APPARATUS
Bennett, Robert M., NASA Langley Research Center, USA; Verification and Validation Data for Computational Unsteady Aerodynamics; October 2000, pp. 173-199; In English; See also 20010009839; Copyright Waived; Avail: CASI; A03, Hardcopy
The supercritical airfoil was chosen as a relatively modem airfoil for comparison. The BOO12 model was tested first. Three different types of flutter instability boundaries were encountered, a classical flutter boundary, a transonic stall flutter boundary at angle of attack, and a plunge instability near M = 0.9 and for zero angle of attack. This test was made in air and was Transonic Dynamics Tunnel (TDT) Test 468. The BSCW model (for Benchmark SuperCritical Wing) was tested next as TDT Test 470. It was tested using both with air and a heavy gas, R-12, as a test medium. The effect of a transition strip on flutter was evaluated in air. The B64AOlO model was subsequently tested as TDT Test 493. Some further analysis of the experimental data for the BOO12 wing is presented. Transonic calculations using the parameters for the BOO12 wing in a two-dimensional typical section flutter analysis are given. These data are supplemented with data from the Benchmark Active Controls Technology model (BACT) given and in the next chapter of this document. The BACT model was of the same planform and airfoil as the BOO12 model, but with spoilers and a trailing edge control. It was tested in the heavy gas R-12, and was instrumented mostly at the 60 per cent span. The flutter data obtained on PAPA and the static aerodynamic test cases from BACT serve as additional data for the BOO12 model. All three types of flutter are included in the BACT Test Cases. In this report several test cases are selected to illustrate trends for a variety of different conditions with emphasis on transonic flutter. Cases are selected for classical and stall flutter for the BSCW model, for classical and plunge for the B64AOlO model, and for classical flutter for the BOO12 model. Test Cases are also presented for BSCW for static angles of attack. Only the mean pressures and the real and

imaginary parts of the first harmonic of the pressures are included in the data for the test cases, but digitized time histories have been archived. The data for the test cases are available as separate electronic files. An overview of the model and tests is given, the standard formulary for these data is listed, and some sample results are presented.
Author
Flutter Analysis; Performance Tests; Airfoils; Aerodynamic Characteristics; Dynamic Tests; Rectangular Wings

20010009847 NASA Langley Research Center, Hampton, VA USA
TEST CASES FOR THE BENCHMARK ACTIVE CONTROLS: SPOILER AND CONTROL SURFACE OSCILLATIONS AND FLUTTER
Bennett, Robert M., NASA Langley Research Center, USA; Scott, Robert C., NASA Langley Research Center, USA; Wieseman, Carol D., NASA Langley Research Center, USA; Verification and Validation Data for Computational Unsteady Aerodynamics; October 2000, pp. 201-224; In English; See also 20010009839; Copyright Waived; Avail: CASI; A03, Hardcopy

As a portion of the Benchmark Models Program at NASA Langley, a simple generic model was developed for active controls research and was called BACT for Benchmark Active Controls Technology model. This model was based on the previously-tested Benchmark Models rectangular wing with the NACA 0012 airfoil section that was mounted on the Pitch and Plunge Apparatus (PAPA) for flutter testing. The BACT model had an upper surface spoiler, a lower surface spoiler, and a trailing edge control surface for use in flutter suppression and dynamic response excitation. Previous experience with flutter suppression indicated a need for measured control surface aerodynamics for accurate control law design. Three different types of flutter instability boundaries had also been determined for the NACA 0012/PAPA model, a classical flutter boundary, a transonic stall flutter boundary at angle of attack, and a plunge instability near M = 0.9. Therefore an extensive set of steady and control surface oscillation data was generated spanning the range of the three types of instabilities. This information was subsequently used to design control laws to suppress each flutter instability. There have been three tests of the BACT model. The objective of the first test, TDT Test 485, was to generate a data set of steady and unsteady control surface effectiveness data, and to determine the open loop dynamic characteristics of the control systems including the actuators. Unsteady pressures, loads, and transfer functions were measured. The other two tests, TDT Test 502 and TDT Test 5 18, were primarily oriented towards active controls research, but some data supplementary to the first test were obtained. Dynamic response of the flexible system to control surface excitation and open loop flutter characteristics were determined during Test 502. Loads were not measured during the last two tests. During these tests, a database of over 3000 data sets was obtained. A reasonably extensive subset of the data sets from the first two tests have been chosen for Test Cases for computational comparisons concentrating on static conditions and cases with harmonically oscillating control surfaces. Several flutter Test Cases from both tests have also been included. Some aerodynamic comparisons with the BACT data have been made using computational fluid dynamics codes at the Navier-Stokes level (and in the accompanying chapter SC). Some mechanical and active control studies have been presented. In this report several Test Cases are selected to illustrate trends for a variety of different conditions with emphasis on transonic flow effects. Cases for static angles of attack, static trailing-edge and upper-surface spoiler deflections are included for a range of conditions near those for the oscillation cases. Cases for trailing-edge control and upper-surface spoiler oscillations for a range of Mach numbers, angle of attack, and static control deflections are included. Cases for all three types of flutter instability are selected. In addition some cases are included for dynamic response measurements during forced oscillations of the controls on the flexible mount. An overview of the model and tests is given, and the standard formulary for these data is listed. Some sample data and sample results of calculations are presented. Only the static pressures and the first harmonic real and imaginary parts of the pressures are included in the data for the Test Cases, but digitized time histories have been archived. The data for the Test Cases are also available as separate electronic files.
Author
Performance Tests; Control Surfaces; Spoilers; Flutter Analysis; Harmonic Oscillation

20010009848 NASA Langley Research Center, Hampton, VA USA
BENCHMARK ACTIVE CONTROLS TECHNOLOGY (BACT) WING CFD RESULTS
Schuster, David M., NASA Langley Research Center, USA; Bartels, Robert E., NASA Langley Research Center, USA; Verification and Validation Data for Computational Unsteady Aerodynamics; October 2000, pp. 225-238; In English; See also 20010009839; Original contains color illustrations; Copyright Waived; Avail: CASI; A03, Hardcopy

The Benchmark Active Controls Technology (BACT) wing test (see chapter 8E) provides data for the validation of aerodynamic, aeroelastic, and active aeroelastic control simulation codes. These data provide a rich database for development and validation of computational aeroelastic and aeroservoelastic methods. In this vein, high-level viscous CFD analyses of the BACT wing have been performed for a subset of the test conditions available in the dataset. The computations presented in this section investigate the aerodynamic characteristics of the rigid clean wing configuration as well as simulations of the wing with a static and oscillating aileron and spoiler deflection. Two computational aeroelasticity codes extensively used at NASA Langley Research Center are implemented in this simulation. They are the ENS3DAE and CFL3DAE computational aeroelasticity programs. Both of these methods solve the three-dimensional compressible Navier-Stokes equations for both rigid and flexible vehicles, but they use significantly different approaches to the solution 6f the aerodynamic equations of motion. Detailed descriptions of both methods are presented in the following section.
Author
Active Control; Aerodynamic Characteristics; Aeroservoelasticity; Computational Fluid Dynamics; Computerized Simulation; Data Bases; Performance Tests

20010009852 National Aerospace Lab., Tokyo, Japan
NAL SST ARROW WING WITH OSCILLATING FLAP
Tamayama, M., National Aerospace Lab., Japan; Saitoh, K., National Aerospace Lab., Japan; Matsushita, H., National Aerospace Lab., Japan; Nakamichi, J., National Aerospace Lab., Japan; Verification and Validation Data for Computational Unsteady Aerodynamics; October 2000, pp. 295-318; In English; See also 20010009839; Copyright Waived; Avail: CASI; A03, Hardcopy

A wind tunnel model of a SST(Supersonic Transport) arrow wing was tested in transonic regime. The purpose of this experiment is to accumulate verification data for the establishment of aeroelasticity related CFD codes and ACT (Active Control Technology) in the Japanese SST program. The model is a semi-span arrow wing with a fuselage. The leading edge is double-swept-backed. The inboard sections of the model was constructed mainly with 7 mm thickness aluminum plate. A NACA0003 airfoil was, then, shaped by urethane resin. The dimensionless coordinates. At outboard sections, the NACA0003 airfoil was directly manufactured by cutting down an aluminum alloy. The detailed information on the model fuselage is shown. There is a flap, which can oscillate in the rear part of the inboard wing. The flap was driven by an electric motor around a hinge shaft which is parallel with the trailing edge. The deflection angle of the flap was measured using an appropriate transducer with installed inside the mode1 fuselage. Downward motion was measured as positive angle. Main measurement items presented here are pressures and deformations of the model. Steady and unsteady components of pressures were measured independently in order to remove the effect of thermal drift of pressure transducers. The pressure orifices are located at positions shown. Chord positions are those for unsteady pressure transducers. The positions of steady pressure orifices are slightly different, because the span positions deviates 0.4% from the unsteady pressure orifices. The steady pressure orifice No. 15 was not available because of the blockage of the vinyl tube, and it is not included in the experimental data provided. The dynamic deformation of the model was measured by tracing optical targets installed in the wing surface. The positions of the optical targets are shown. Multiple targets distributed in spanwise direction were measured with a single CCD camera. Four CCD cameras were used. While there were problems with the light intensity and some of the camera measurement systems failed, dynamic deformations were obtained at the target positions shown. Four accelerometers are installed in the model. The locations are shown. The accelerometer signals are useful for the verification of the dynamic deformation measurement system. CD-ROM show the

results of steady and unsteady components of pressure coefficient, unsteady aerodynamic forces, steady and dynamic optical target displacement, and unsteady accelerometer signals. The unsteady results are presented only by the fundamental and 2nd harmonic components based on the flap frequency. The FFT function of Matlab was utilized in the frequency analysis. After data were FFT-processed in several intervals beginning from different time, they were averaged. The data length was double the sample frequency for each FFT-processing. The unsteady presented results are not normalized by the flap amplitude. The phase characteristics are presented with respect to the flap motion. The results are also shown (the whole set of figures is included in the accompanying CD-ROM here only some examples are presented). In these figures, only the fundamental component normalized by flap amplitude is shown.
Author
Wind Tunnel Models; Supersonic Flow; Aeroelasticity; Data Processing; Computational Fluid Dynamics; Active Control

20010009853 Institute for Aerospace Research, Ottawa, Ontario Canada
TRANSONIC BUFFET OF A SUPERCRITICAL AIRFOIL
Huang, X. Z., Institute for Aerospace Research, Canada; Lee, B. H. K., Institute for Aerospace Research, Canada; Tang, F. C., Institute for Aerospace Research, Canada; Verification and Validation Data for Computational Unsteady Aerodynamics; October 2000, pp. 319-339; In English; See also 20010009839; Copyright Waived; Avail: CASI; A03, Hardcopy

This investigation was carried out in the Institute for Aerospace Research (IAR) 2D High Reynolds Test Facility to study the buffet characteristics of a supercritical airfoil, BGK No. 1. Steady, unsteady surface pressure and normal force were measured at various angles of attack and Mach numbers. The statistical properties of the normal force and pressure were carried out by spectral analyses. Buffet onset boundaries were evaluated from the divergence of the fluctuating normal force while buffet intensities were determined from the normal force measurements. The attached and separated flow regions on the airfoil as well as the merging of a shock induced separation bubble with the trailing edge separation region were determined by skin friction measurements. The test program is presented in Table 1. There are two BGK No.1 models. One has normal static pressure orifices and 6 pressure ports to measure pressure fluctuations (BGK-1). Another has 15 fast response transducers (BGK-l(m)). The model#s coordinates and the locations of pressure orifices and transducers are listed (in CD-ROM). The experimental arrangement and results have been described in detail. Tabulated data and illustrations are presented in CD-ROM with part of the illustrations shown here. Typical power spectra of the normal force are shown. The frequencies of the shock motion vary from 70-80 Hz for the Mach number range of 0.688-0.796 and are partly are listed. The flow conditions where discrete shock oscillations were detected are summarized. The test program for BGK-l(m) can be sorted in three cases: 1) points A, B, C, D, and E; 2) points a, b, c, d and e; and 3) points 1, 2, 3, 4, and 5 respectively. The shaded region was obtained by fixing a Mach number but varying the incidence in the experiment. A power spectra plot of the normal force was computed at each a and the presence of shock waves was determined from observing whether the 70-80 Hz peak was present or not. The buffet boundary, which was obtained from divergence of the fluctuating normal force, is included in this figure for reference. This buffet onset is identified from the divergence of the normal force fluctuations by noting the point on the curve with a slope dCk /dCL=O. 1. This value is arbitrarily chosen, but in those cases where buffet onset is primarily due to trailing edge separations, this criterion for deriving the buffet boundary is found to give consistent results and agrees with values computed from trailing edge pressure divergence. The static surface pressure distributions are listed in Table 6 with some examples shown here. The cross-hatched and open bar symbols denote regions of attached and separated flows determined from skin friction measurements. The unsteady pressure or the pressure intensities along airfoil chord of BGK-1 and BGK- 1 (m) models are presented. The corresponding figures are shown. The statistical properties such as power and cross power spectral density, auto and cross correlation functions, as well as coherence functions of pressure and normal force have been measured at different Mach numbers and angles of attack. As examples shows a set of the spectral analyses at the condition of M=0.753 and a=5.66 for BGK-1 model. The frequency response of the installed transducers was calibrated and established to be flat up to approximately 200 Hz. The normal force signal was obtained at the sampling frequency of 1.6 kHz. Power spectra of unsteady pressure on upper surface of BGK-l(m) at different locations. The cross correlation functions between different transducers at M=0.688 and (x=3.99, 6.43 and 9 are shown. The pressure-time histories on BGK-l(m) model at M=0.7 1 and various a are presented. The unsteady pressure fluctuations behind the periodic shock wave have two contributions. One is from a random component associated with the turbulent motion in the separated flow region. Another is a deterministic part from the pressure field as a result of shock wave oscillation. Thus, approximately 175 ensemble averages of the pressure signals were performed. Each ensemble, which was synchronized to the zero crossings decided from balance normal force spectra, had 32 samples. A Fourier analysis was then performed to obtain the fundamental and harmonics of the oscillatory pressure field.
Author
Airfoils; Buffeting; Aerodynamic Characteristics; Bgk Model; Pressure Distribution; Frequency Response; Cross Correlation; Spectrum Analysis

20010009854 Defence Evaluation Research Agency, Farnborough, UK
BUFFET DATA FROM M2391 DIAMOND WING
Kaynes, I. W., Defence Evaluation Research Agency, UK; Verification and Validation Data for Computational Unsteady Aerodynamics; October 2000, pp. 341-359; In English; See also 20010009839; Copyright Waived; Avail: CASI; A03, Hardcopy

Unsteady aerodynamic loads may be described in terms of the aerodynamic excitation arising from unsteady separated flows (buffet) or the associated uncoupled structural response (buffeting). Buffeting response measurements are usually made on nominally rigid or aero-elastically tuned models, with buffeting levels determined from the narrow band response of wing root strain gauges or wing tip mounted accelerometers. In such cases the model structural dynamics are tuned to provide sufficient buffeting response. Detailed studies have suggested that the first stage in the successful prediction of full scale 'buffeting' must be the prediction of 'buffet', unless a dynamically scaled structure can be employed. Early in the design stage, the structural characteristics of a configuration are generally unknown. Dynamically scaled models are also expensive to design and manufacture and are therefore not considered a practical solution. The use of traditional construction 'flexible' models to measure 'buffet' lead to serious difficulties in the interpretation of aerodynamic data with the measured buffet excitation comprising components due to the unsteady flow field and components due to model vibration. Furthermore, the combination of a conventional wind tunnel model on a typical steel wind tunnel support structure frequently results in combined model and support natural frequencies in the region of aerodynamic interest for buffet measurement. A buffet test technique was therefore developed at DERA Bedford to enable 'pure' unsteady aerodynamic data to be acquired free from model and support structure interference. The technique centres around the use of low mass, high stiffness models with structural frequencies above the frequency range of aerodynamic interest and a new low natural frequency model support system referred to as the Buffet Support Fixture (BSF). The BSF is shown in Figure 1 and comprises a 2-tonne mounting block attached to two stiff lateral box beams. The box structure is in turn suspended from the tunnel floor on flexible elastomeric bearings. The combination of a large mass on low stiffness mountings provides a support structure with only low natural frequency modes of vibration. The support system natural frequencies are lower than the buffet excitation frequencies expected for half models in the 13ft x 9ft low speed tunnel and are typically less than 17Hz. The BSF natural frequency can be tuned by the addition of extra mass to the block or by modification of the elastomeric bearings. High natural frequency buffet models are provided by low mass, high stiffness models fabricated using a carbon fibre and foam core construction technique. The combined model and support system structural interference is restricted to limits outside of the domain of aerodynamic interest providing a wide frequency window within which 'pure' aerodynamic data can be measured. The first wing buffet planform to be manufactured at DERA Bedford was model M2391. This model is a 40 degree leading edge sweep, half model diamond wing with a stream-wise clipped tip as shown. The model was constructed using a carbon fibre and foam-core construction technique. A rigid foam core (Rohacell 51)

was bonded to a 50mm thick aluminium root block and numerically-controlled machined from solid to the desired profile. The assembly was slotted to support internal instrumentation and skinned with an 8 layer carbon tibre laminate, each layer 0.125mm thick. A cold cure technique was employed, with each successive layer rotated through an additional 45 deg to provide the required directional strength. Although the 10% t/c ratio wing section shape is not representative it was generally agreed that the large scale buffet distribution and magnitude would be dominated by the low aspect ratio of the planform. Model M2391 has interchangeable rectangular and chined fuselages, with the rectangular fuselage providing a perpendicular wing-fuselage interface. The chined fuselage allows the buffet due to mixed vertical flows to be studied. The model mounted in the DERA Bedford 13ft x 9ft low speed wind tunnel are shown.
Author
Aerodynamic Loads; Unsteady Aerodynamics; Buffeting; Design Analysis; Dynamic Structural Analysis

20010009855 Institute for Aerospace Research, Ottawa, Ontario Canada
WING AND FIN BUFFET ON THE STANDARD DYNAMICS MODEL
Huang, X. Z., Institute for Aerospace Research, Canada; Zan, S., Institute for Aerospace Research, Canada; Verification and Validation Data for Computational Unsteady Aerodynamics; October 2000, pp. 361-381; In English; See also 20010009839; No Copyright; Avail: CASI; A03, Hardcopy

For modern aircraft with higher sweep angles flying at higher incidence, unsteady and burst vortex flow in the vicinity of the wing and downstream lifting surface lead to strong unsteady airloads and buffeting. Thus, investigations were conducted in the Institute for Aerospace Research (IAR) Low Speed Wind Tunnel (LSWT) to study the buffet characteristics of the Standard Dynamics Model (SDM), a generic fighter aircraft configuration. Since the spectrum of the aerodynamic input load is reasonably flat over the frequency range of interest, the solution to the equation of the motion is easily solved in the frequency domain for a given aerodynamic loads and vice versa. Following Jones and Mabey, it is suggested that m is the best parameter to use as a measure of buffet excitation due to flow separations and unsteadiness and to denote this as the buffet excitation parameter. Buffeting is presented for three modes - the fin bending mode (VFB) and the wing symmetric and anti-symmetric bending modes (WSB and WAB). The strain gauges were mounted approximately on the node line of the torsional mode. It should be emphasized that since the model is rigid and the deformation of the structure and its damping are negligible, this measurement is linearly related to the buffet excitation. In addition, experimental results of static coefficients at angles of attack ranging from 0 deg to 90 deg are also included for the understanding of the flow behavior during the experiments. The geometry of SDM is shown. There are two SDM models with ratio of 0.375 (SDM-L and SDM- S) used for buffet/dynamic stability and static experiments respectively. The SDM model was sting-mounted in the wind tunnel, which in turn was protruded from a strut cantilevered in the wind tunnel floor as shown. The pitch angle is obtained by turning the strut through the center of the turntable. Sideslip angle setting is effected by banking the model about the body axis. The flow visualization results show that at beta = 0 deg, separation becomes evident on the wing at alpha approx. = 4 deg in the case of strakes removed and alpha approx. = 15 deg in the case of strakes installed. At alpha approx. = 20 deg, the vortex burst reaches the wing trailing edge while it breaks down completely over the wing at alpha approx. = 29 deg. The onset of asymmetrical forebody vortices appears at alpha approx. = 40 deg. The test matrix for the buffet characteristics is presented. The experimental results of static coefficients and buffet characteristics at different conditions are listed in the CD-ROM and illustrated. The reference center for the moment is at 35% of MAC. The results with a dummy strut which was installed on the tunnel ceiling to investigate the asymmetrical effect of the strut are shown. The shapes of different modes for the purpose of locating the strain gauges are shown. In general, the level of fin buffeting exceeds that of wing buffeting by an order of magnitude. In connecting with static measurements and flow visualizations this severe fin buffeting arises from the fact that the fin is immersed in the wake of the burst of strake and/or forebody vortices. The peak of fin buffet excitation is near an angle of attack corresponding to the onset of asymmetrical forebody flow. The magnitude of the wing buffet excitation parameter did not exceed 0.003, which arose from the interaction of the strake and wing vortices or simply from separated flow unsteadiness over the wing.
Author
Aerodynamic Loads; Angular Distribution; Boundary Layer Separation; Buffeting; Dynamic Stability

20010018863 Research and Technology Organization, Systems, Concepts and Integration Panel, Neuilly-sur-Seine, France
FLIGHT CONTROL DESIGN: BEST PRACTICES *[LA CONCEPTION DES SYSTEMES DE COMMANDE DE VOL: LES MEILLEURES PRACTIQUES]*
December 2000; 214p; In English; Original contains color illustrations; CD-ROM contains full text document in PDF format
Report No.(s): RTO-TR-029; AC/323(SCI)TP/23; ISBN 92-837-1047-9; Copyright Waived; Avail: CASI; A10, Hardcopy; A03, Microfiche; C01, CD-ROM

Accidents due to adverse aircraft-pilot coupling phenomena in the latest technology aircraft occurred both in the US and in Europe, while other programs had less-well-publicized flight control development problems. These events showed that a robust and affordable solution to the development process of digital flight control systems was not universally available. This Technical Report begins with a review of some examples of flight control problems. They span the history of flight from the time when the practice of flying was preceding theoretical developments up to the recent events. There is a chapter detailing lessons learned from various programs with positive results. The review of problems and lessons learned leads into a chapter detailing a series of recommended design best practices. The best practices are laid out as a logical process with recommendations for avoiding the pitfalls that have led to problems in the past. The second part of the report continues with some theoretical aspects, such as flying qualities criteria and 'carefree handling', the latest results from analytical and research activities into PIOs, and modelling and system identification to support the design process. The report concludes with suggestions for required future research.
Author
Flight Control; Control Systems Design; Pilot Induced Oscillation; Aircraft Control; Pilot Error

20010067672 Deutsches Zentrum fuer Luft- und Raumfahrt e.V., Inst. fuer Stroemungsmechanik, Goettingen, Germany
ACTIVE FLOW CONTROL APPLIED TO MILITARY AND CIVIL AIRCRAFT
Stanewsky, E., Deutsches Zentrum fuer Luft- und Raumfahrt e.V., Germany; Rosemann, H., Deutsches Zentrum fuer Luft- und Raumfahrt e.V., Germany; Active Control Technology for Enhanced Performance Operational Capabilities of Military Aircraft, Land Vehicles and Sea Vehicles; June 2001, pp. K1-1 - K1-16; In English; See also 20010067671; Original contains color illustrations; Copyright Waived; Avail: CASI; A03, Hardcopy

There are essentially two aspects to the application of active flow control. Firstly, the improvement of aircraft performance otherwise restricted by the development of the boundary layer and the interaction of the boundary layer with the outer 'inviscid' flow field, exacerbated at high speed by the occurrence of shock waves which considerably increase aircraft drag; secondly, the direct control of the aircraft geometry to adjust to changing flight or freestream conditions for optimized performance at all points of the flight envelope. In the present paper both aspects are being considered and flow control and adaptive-wing concepts for military and civil air vehicle applications discussed. Examples for each control objective are provided and benefits associated with implementing adaptive-wing and flow-control technologies outlined. The discussion is based on results from the literature and results of two recent projects, namely, the German national adaptive-wing project ADIF and the EU-project EUROSHOCK II, the latter concerned with boundary layer and shock control. Main emphasis is being placed on aerodynamics.
Author
Active Control; Aerodynamics; Flow Distribution; Boundary Layer Control; Inviscid Flow

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THEORY OF CONTROL ASPECTS
Gobert, Jean-Louis, Office National d'Etudes et de Recherches

Aerospatiales, France; Active Control Technology for Enhanced Performance Operational Capabilities of Military Aircraft, Land Vehicles and Sea Vehicles; June 2001, pp. K4-1 - K4-12; In English; See also 20010067671; Original contains color illustrations; Copyright Waived; Avail: CASI; A03, Hardcopy

The wide field of possible applications in various areas is one of the most fundamental aspects of control theory, the disciplines range from mechanics to finance through power plants, aeronautics, electronics, biotechnology, air traffic, control, etc. As a consequence, any application involving control requires the cohabitation of control engineers and engineers from other disciplines; generally of scientific background, education, and culture of those categories of engineers are quite different. The contact between several cultures leads often to understanding and communication difficulties, which could jeopardize the normal development of a project. In extreme cases, control theory will be considered as an isoteric discipline dedicated to few specialists; a similar observation would surely exist in case cohabitation must be required between disciplines such as aerodynamics and psychology or finance. Control theory is well known for its ability to design devices in order to robustly control and/or stabilize a process in presence of perturbations, parameter variations, and/or unmodeled dynamics. But, it shall not be forgotten that control is also the discipline of analysis, modelling, identification, simulation, evaluation, diagnosis, and optimization. This short document seeks to show how the communication between participants from the different disciplines can be improved by taking into account the control discipline at an early stage of the project and by intensively using the capabilities of modelling. It is demonstrated that this approach enables to create a new synergy by taking the best of the complementary, aspects of the different cultures. An illustration, based on a traditional application experience gained during the design and construction phases of the European Transonic Wind tunnel (ETW), erected in Cologne (Germany), is given at the end of the document.
Author
Control Theory; Project Planning; Dynamic Models

20010067681 Warsaw Univ. of Tech., Inst. of Aeronautics and Applied Mechanics, Warsaw, Poland
IMPULSE CONTROL OF ANTI-TANK MORTAR MISSILE
Vogt, Ryszard, Warsaw Univ. of Tech., Poland; Glebocki, Robert, Warsaw Univ. of Tech., Poland; Active Control Technology for Enhanced Performance Operational Capabilities of Military Aircraft, Land Vehicles and Sea Vehicles; June 2001, pp. 6-1 - 6-7; In English; See also 20010067671; Original contains color illustrations; Copyright Waived; Avail: CASI; A02, Hardcopy

This report explains the problem of control dynamics of a flying object with discontinuous impulse control inputs. Control is restaged by the rocket correction motors located around the center of gravity of the flying object. Motor start up causes formation of the force impulse directly perpendicular to main symmetry axis of object and directs the force along axis crossing object's center of gravity. We tested the possibilities of a more effective influence on the speed vector by impulse correction motors.
Author
Impulses; Control Systems Design

20010067687 DaimlerChrysler Aerospace A.G., Military Aircraft Div., Munich, Germany
THRUST VECTORING FOR ADVANCED FIGHTER AIRCRAFT: HIGH ANGLE OF ATTACK INTAKE INVESTIGATIONS
Bissinger, Norbert C., DaimlerChrysler Aerospace A.G., Germany; Jost, Michael, DaimlerChrysler Aerospace A.G., Germany; Active Control Technology for Enhanced Performance Operational Capabilities of Military Aircraft, Land Vehicles and Sea Vehicles; June 2001, pp. 13-1 - 13-13; In English; See also 20010067671; Original contains color illustrations; Copyright Waived; Avail: CASI; A03, Hardcopy

In this paper the results of investigations will be presented which dealt with the determination of intake flows at high and very high angles of attack. The overall approach comprised of experimental and numerical (computational fluid dynamics) investigations will be detailed. Results and comparisons between flows at small and large angles of attack will be used to try to clarify the origin of possible disturbances in the intake flow. Intake bleed and the flow losses at the intake entrance are identified as major components contributing to the quality of the intake flow at the engine face.
Author
Computational Fluid Dynamics; Thrust Vector Control; Flow Distribution; Wind Tunnel Tests

20010067689 Office National d'Etudes et de Recherches Aerospatiales, Dept. Models for Aerodynamics and Energetics, Toulouse, France
BUFFET ACTIVE CONTROL: EXPERIMENTAL AND NUMERICAL RESULTS
Despre, C., Office National d'Etudes et de Recherches Aerospatiales, France; Caruana, D., Office National d'Etudes et de Recherches Aerospatiales, France; Mignosi, A., Office National d'Etudes et de Recherches Aerospatiales, France; Reberga, O., Office National d'Etudes et de Recherches Aerospatiales, France; Correge, M., Office National d'Etudes et de Recherches Aerospatiales, France; Gassot, H., Office National d'Etudes et de Recherches Aerospatiales, France; LeBalleur, J. C., Office National d'Etudes et de Recherches Aerospatiales, France; Girodroux-Lavigne, P., Office National d'Etudes et de Recherches Aerospatiales, France; Active Control Technology for Enhanced Performance Operational Capabilities of Military Aircraft, Land Vehicles and Sea Vehicles; June 2001, pp. 15-1 - 15-13; In English; See also 20010067671; Original contains color illustrations; Copyright Waived; Avail: CASI; A03, Hardcopy

The study aims are the active control of transonic buffet over airfoils and wings. A new moving device at the trailing-edge, a so-called 'Trailing Edge Deflector' (TED) designed at ONERA, is used to decrease the buffet instabilities. This study is limited to buffet phenomenon on upper surface of a stiff 2D airfoil in transonic flow. Experimental and numerical results allow to better understand the phenomena and to validate the efficiency of the TED. The TED can be moved sequentially to a static position, or better be driven by dynamic servo-motions. A selected static position increases aerodynamic performances for high lift coefficient and delays the buffet onset vs lift. A preferable TED active control law, coupled with measured flow signals, allows to greatly reduce the aerodynamic instabilities. The time-consistent strong viscous-inviscid interaction approach VIS15, developed previously for computing buffet or unsteady separated flows over airfoils, gives access to a direct time-accurate simulation of the active buffet control by TED servo-command, both in open-loop control, and in the closed-loop servo-command driven by the computed self-induced signals of buffet.
Author
Buffeting; Shock Wave Interaction; Active Control; Transonic Flow; Efficiency

20010067693 DaimlerChrysler Aerospace A.G., Military Aircraft, Munich, Germany
YAW CONTROL AT HIGH ANGLES OF ATTACK THROUGH VORTEX MANIPULATION USING ROTATING NOSE STRAKES
Hakenesch, Peter R., DaimlerChrysler Aerospace A.G., Germany; Active Control Technology for Enhanced Performance Operational Capabilities of Military Aircraft, Land Vehicles and Sea Vehicles; June 2001, pp. 21-1-21-6; In English; See also 20010067671; Original contains color illustrations; Copyright Waived; Avail: CASI; A02, Hardcopy

The effect that nose makes on the flow field in the vicinity of the forward fuselage section of an aircraft was investigated. Emphasis was placed on the manipulation of the vortices in order to generate a significant side force and yawing moment with the purpose not only to stabilize the aircraft at high angles of incidence, but also to achieve yaw control. Aside from conventional control surfaces, an additional control device was realized by mounting a single strake on the nose section which could be rotated around its longitudinal axis. Experimental force and pressure data from low speed wind tunnel tests indicate the potential of this control device for aircraft flying at high angles of attack.
Author
Flow Distribution; Wind Tunnel Tests; Fuselages; Strakes; Yaw

20010067694 Carleton Univ., Dept. of Mechanical and Aerospace Engineering, Ottawa, Ontario Canada
ACTIVE CONTROL OF FOREBODY VORTICES ON A SCHEMATIC AIRCRAFT MODEL
Lee, R., Carleton Univ., Canada; Kind, R. J., Carleton Univ., Canada;

Hanff, E. S., National Research Council of Canada, Canada; Active Control Technology for Enhanced Performance Operational Capabilities of Military Aircraft, Land Vehicles and Sea Vehicles; June 2001, pp. 22-1 - 22-13; In English; See also 20010067671; Copyright Waived; Avail: CASI; A03, Hardcopy

A wind tunnel experiment has been performed to further investigate the potential of the dynamic manipulation of forebody vortices as a means of supplementing directional control of fighter aircraft at high angles of attack. Tests were conducted on a 65-deg delta-wing model fitted with a slender, pointed tanget-ogive forebody of circular cross-section. Forward blowing nozzles located near the apex of the forebody served as the means of perturbing the forebody vortices. Results have shown that a linear relationship exists between the time-average yawing moment coefficient and a duty cycle parameter. These results, however, are accompanied by a peculiar reversal of yawing moment and side force that occurs when the blowing momentum exceeds a particular threshold value. Cross-coupling effects were also identified between the control method and time-average rolling moment, pitching moment, and normal force.
Author

Active Control; Aircraft Models; Forebodies; Vortices; Wind Tunnel Tests

20010067696 Office National d'Etudes et de Recherches Aerospatiales, Paris, France

ACTIVE CONTROL OF THE FLOW AROUND A LARGE-ANGLE NOSE SECTION *[CONTROLE ACTIF DE L'ECOULEMENT AUTOUR D'UNE POINTE AVANT A GRANDE INCIDENCE]*

Francois, C., Office National d'Etudes et de Recherches Aerospatiales, France; Active Control Technology for Enhanced Performance Operational Capabilities of Military Aircraft, Land Vehicles and Sea Vehicles; June 2001, pp. 23-1 - 23-10; In French; See also 20010067671; Original contains color illustrations; Copyright Waived; Avail: CASI; A02, Hardcopy

As part of the federative project entitled 'Active Control of Flows' conducted at ONERA, a study was conducted to validate the principle of lateral control of a large-angle airplane by alternately blowing air on the nose section. Wind tunnel tests of a generic test model front section allowed us to determine the effects of different parameters on the changes in the organization of front-end vortices and to select an operating mode for the actuator requiring moderate output. The displays produced in rapid succession revealed the dynamic characteristics of overbalancing the vortices, and peripheral detectors capable of tracking their developments in real time were selected to be able to control the position of the lines of separation on the test model.
Author

Active Control; Dynamic Characteristics; Vortices; Wind Tunnel Tests; Lateral Control

20010067697 Air Force Research Lab., Wright-Patterson AFB, OH USA

FIGHT CONTROL DESIGN BEST PRACTICES RELATIVE TO ACTIVE CONTROL TECHNOLOGY

Moorhouse, David J., Air Force Research Lab., USA; Active Control Technology for Enhanced Performance Operational Capabilities of Military Aircraft, Land Vehicles and Sea Vehicles; June 2001, pp. 25-1 - 25-8; In English; See also 20010067671; Copyright Waived; Avail: CASI; A02, Hardcopy

Task Group SCI-26 was formally initiated in 1996, in response to well-publicized and highly visible accidents that had occurred in the latest technology aircraft both in the US and in Europe. These accidents were due to deficiencies in the flight control system designs. Other recent programs had less-well-publicized FCS development problems, with time and cost overruns more the rule than the exception. The Task Group has just published a report, which begins with a review of some examples of flight control problems. They span the history of flight from the time when the practice of flying was preceding theoretical developments up to more recent time when it might be thought that flight control designers 'should know better'. Then there is a chapter detailing lessons learned from various programs with positive results, which leads into a section detailing a series of recommended best practices. The second part of the report continues with some theoretical aspects. First, there is a discussion of flying qualities criteria, and the current state of the art of 'carefree handling' which is related to this symposium. Next there is an extensive discussion of the latest results from research into PIOs, followed by a discussion of modelling and system identification. The Task Group members originally laid out this report to present an assessment of design methods, but no correlation was found between the method used and the problems of the past, or the successes. The theme of the symposium, 'Active Control Technology', is interpreted to mean the use of flight control technology to minimize the pilot's workload in accomplishing every mission task. Specifically, it covers a range of applications from tailoring the responses to prevent undesirable characteristics, such as departures or limit exceedances, all the way through to automatic recovery systems that take control away from the pilot. The objective of this paper is to summarize the Task Group results with particular emphasis on best design practices to achieve the optimum benefits from active control technology (ACT).
Author

Active Control; Flight Control; Control Systems Design

20010067698 BAE Systems, UK

THRUST VECTOR CONTROL AND VISUALISATION FOR STOVL AIRCRAFT

Lodge, P. M., BAE Systems, UK; Fielding, C., BAE Systems, UK; Active Control Technology for Enhanced Performance Operational Capabilities of Military Aircraft, Land Vehicles and Sea Vehicles; June 2001, pp. 26-1 - 26-9; In English; See also 20010067671; Original contains color illustrations; Copyright Waived; Avail: CASI; A02, Hardcopy

There are many areas where the design of control laws for short take-off and vertical landing (STOVL) aircraft are radically different from those of a conventional design. One the most challenging areas is related to control of the thrust vector, and in particular, how to design control laws that can deal with conflicting demands, control saturation, and integrator wind-up. Unlike a conventional aircraft, where full primary control surface deflections are rarely used, the STOVL aircraft nozzle vector angle and engine thrust are often operated on their limits for significant periods of time. For example, to achieve maximum deceleration from wing-borne flight, the nozzles are vectored to their forward authority limits and remain there for several seconds. The first part of this paper provides background on the UK's Integrated Flight and Propulsion System (IFPCS) program, the BAE SYSTEMS P112C-6 aircraft configuration, and the Rolls-Royce RB571 engine concept. A command strategy to control the aircraft during wing-borne flight and through the transition to the hover is introduced, which leads to the description of a suitable control law architecture to satisfy this command strategy. With the approach chosen, 'thrust vector equations' are required to transform the pilot's commands into nozzle vector angle and engine thrust demands. The equations are derived for the Harriet and subsequently for the more complex P112C-6 in configuration. These equations are then extended to cover the cases of saturated control conditions. Emphasis is placed on the visualization and verification of the complex functions that result. Discussion of the application of the thrust vector equations in a non-linear real-time simulation, including flight and engine control system integration aspects, is also covered and the paper concludes with lessons learned in this area.
Author

Computerized Simulation; Stovl Aircraft; Thrust Vector Control; Control Theory

20010067700 Hoh Aeronautics, Inc., Lomita, CA USA

NONLINEARITIES AND PIO WITH ADVANCED AIRCRAFT CONTROL SYSTEMS

Mitchell, David G., Hoh Aeronautics, Inc., USA; Field, Edmund J., Boeing Co., USA; Active Control Technology for Enhanced Performance Operational Capabilities of Military Aircraft, Land Vehicles and Sea Vehicles; June 2001, pp. 28-1 - 28-13; In English; See also 20010067671

Contract(s)/Grant(s): F33615-95-C-3608; Copyright Waived; Avail: CASI; A03, Hardcopy

Design methods for advanced aircraft control systems include feedbacks to stabilize relaxed-static-stability vehicles, command and feedback shaping, and gain scheduling. Extensive use of such designs increases the risk of adverse nonlinear response to pilot control inputs. A common form of this adverse response is pilot-induced oscillation (PIO). This paper examines the relationship between nonlinearities in advanced aircraft control systems and PIO. The results of recent research clearly demonstrate that actuator rate limiting alone does not always cause PIO. Other factors, such as the

degree of instability of the unaugmented airplane and level of excess demand on the control surface, are greater determinants of PIO susceptibility. The paper evaluates two other, less thoroughly documented, contributors to PIO command shaping (sensitivity) and hysteresis in the flight controls. Inferences about their impact on PIO may be made, but there is not enough data to draw specific conclusions.
Author
Aircraft Control; Control Systems Design; Pilot Induced Oscillation

20010067703 Leicester Univ., Dept. of Engineering, UK
PRACTICAL ASPECTS OF IMPLEMENTING H-INFINITY CONTROLLERS ON A FBW RESEARCH HELICOPTER
Walker, D. J., Leicester Univ., UK; Turner, M. C., Leicester Univ., UK; Gubbels, A. W., National Research Council of Canada, Canada; Active Control Technology for Enhanced Performance Operational Capabilities of Military Aircraft, Land Vehicles and Sea Vehicles; June 2001, pp. 31-1 - 31-8; In English; See also 20010067671; Original contains color illustations; Copyright Waived; Avail: CASI; A02, Hardcopy

This paper presents a summary of the design and testing of two H-infinity controllers, recently flight-tested on the NRC's Bell 205 experimental fly-by-wire helicopter. Lessons learned from the implementation and testing are described. Both designs were based on low-order mathematical models and H-infinity optimization. The first controller successfully engaged first time, and is believed to be the first H-infinity controller flight-tested on a rotorcraft. It was subsequently evaluated at hover and low/moderate speed by a test-pilot and found to achieve level 2 Cooper Harper Handling Qualities on a number of tasks. The controller was redesigned using a different mathematical model and a different H-infinity cost-function. The result was a significant reduction in cross-couplings, better (though still Level 2) handling qualities ratings of 4-5, Level 1 pitch and roll bandwidths. This paper presents an analysis of data from these flights. The flight testing provided a number of important practical lessons that could be useful to anyone attempting to implement and test modern controllers in flight. The gap between robustness of the design method and accuracy of the flight mechanic model is one of the most critical issues in high bandwidth control. Improved aircraft models translate directly into better controller performance. Validation of the aircraft model against open loop helicopter flight test data has shown that both the models used were deficient in a variety of ways. Software implementation should be kept as simple as possible; a discussion of the methods used for this project is given. The use of an onboard aircraft model greatly assisted in trouble-shooting the code for errors before flying. Use of automated code generation greatly reduces transfer errors from the Matlab design environment. To assess new control laws fully, an experienced test pilot is essential.
Author
Controllability; Controllers; Flight Tests; H-Infinity Control; Control Systems Design

20010067704 Naval Air Systems Command, Airworthiness/Flight Clearance Office, Patuxent River, MD USA
OPERATIONAL LESSONS LEARNED FROM THE F/A-18E/F TOTAL FLIGHT CONTROL SYSTEMS INTEGRATION PROCESS
Hanley, Robert J., Naval Air Systems Command, USA; Dunaway, David A., Department of the Navy, USA; Lawson, Kenneth P., Naval Air Systems Command, USA; Active Control Technology for Enhanced Performance Operational Capabilities of Military Aircraft, Land Vehicles and Sea Vehicles; June 2001, pp. 32-1 - 32-11; In English; See also 20010067671; Original contains color illustrations; Copyright Waived; Avail: CASI; A03, Hardcopy

The F/A-18E/F Super Hornet is a growth version of the F/A-18A through D model 'heritage' Hornet, first fielded in 1983. Some of the primary design goals for the Super Hornet included increasing the range, providing greater weapon loading flexibility, increasing carrier landing bring back weight, and improving survivability. Improving the survivability was addressed in various ways, including reductions in radar cross section, expanded self-protection systems, and enhanced maneuverability. The heritage Hornet was the first tactical aircraft in the world to fully exploit high Angle of Attack (AOA) maneuvering in the air combat environment. The heritage Hornet is widely known for its ability to attain and maintain high angles of attack, providing the pilot with a distinct advantage in the low airspeed, high AOA arena. Hornet pilots have achieved great success by simply 'intimidating' threat aircrews. This intimidation can cause threat pilots to make grave tactical maneuvering errors in this flight regime. Despite these capabilities, the heritage Hornet has had a history of inadvertent departures from controlled flight, mostly in the low speed, high AOA flight regime. Heritage Hornet pilots must always maintain situational awareness of their aircraft state (aircraft store loading in combination with perceived yaw rate and sideslip, AOA and airspeed) to ensure they do not inadvertently cause one of these departures. One of the primary goals for improving the Super Hornet's maneuverability included addressing the total systems design and integration of the Flight Control System (FCS), Operational Flight Program (OFP), and Mission Computers (MC) in order to optimize the control effectors in all phases of flight, including failure modes and battle damage. This integration would be key to approaching, if not achieving, an inherent ability within the Super Hornet to be maneuvered without concern for inadvertent departures, even with heavy and/or asymmetric store loadings, and to remain a safe and potentially lethal weapon system even with flight control failures or battle damage to some control surfaces. This paper addresses this total integrated design with the FCS, OFP, and MCs in the Super Hornet, including discussion on how the control effectors were integrated with feedback sensors to reduce the likelihood of departures, how the flight envelope was expanded to provide greater maneuverability, some surprise lessons learned on the control of asymmetric flow characteristics over the wing, and the positive and negative lessons learned from this design concept by the fleet operators.
Author
Flight Control; F-18 Aircraft; Aircraft Survivability; Aircraft Performance; Control Systems Design

20010067709 Carleton Univ., Dept. of Mechanical and Aerospace Engineering, Ottawa, Ontario Canada
FINITE ELEMENT APPROACH FOR THE DESIGN OF CONTROL ALGORITHMS FOR VERTICAL FIN BUFFETING USING STRAIN ACTUATION
Nitzsche, Fred, Carleton Univ., Canada; Zimcik, David G., Institute for Aerospace Research, Canada; Liberatore, Sauro, Institute for Aerospace Research, Canada; Active Control Technology for Enhanced Performance Operational Capabilities of Military Aircraft, Land Vehicles and Sea Vehicles; June 2001, pp. 8-1 - 8-10; In English; See also 20010067671; Copyright Waived; Avail: CASI; A02, Hardcopy

It is difficult to predict buffet loads during the design stage of an aircraft. The present work describes the control design method used to address this problem for the F/A-18 aircraft which is often subjected to high-intensity buffet loads that produce high accelerations at the tip the vertical fin during maneuvers at high angles of attack. A NASTRAN finite-element model was constructed to represent the dynamics of the structure at the low frequencies of interest. The aeroelastic frequency response analysis and the thermal analogy available in NASTRAN were used together in a two-step procedure to simulate the strain actuation. This analysis was conducted for each group of actuators to obtain the transfer functions between the two control inputs (actuation groups), the disturbance (buffet load), and the two output variables (a choice among four accelerometers and five strain-gauge positions). Three independent white noise signals limited by the frequency band between 0 and 120 Hz were used in development of a 2x2 MIMO system. The result was a control system using strain actuation to attenuate the dynamic response caused by buffet loads. The predicted results were compared to full-scale test results in the MOST Program test facility in Australia. The results demonstrated significant reductions in the root-mean-square (RMS) values of the fin dynamic response measured by the strain transducer at the critical point for fatigue at the root were achieved under the most severe buffet condition.
Author
Buffeting; Fins; Control Systems Design; Dynamic Response

20010067710 ZONA Technology, Inc., Scottsdale, AZ USA
ACTIVE FLUTTER SUPPRESSION USING ASTROS WITH SMART STRUCTURES AND ASE MODULES
Nam, C., ZONA Technology, Inc., USA; Chen, P. C., ZONA Technology, Inc., USA; Liu, D. D., Arizona State Univ., USA; Active Control Technology for Enhanced Performance Operational Capabilities of Military Aircraft, Land Vehicles and Sea Vehicles; June 2001, pp. 9-1

- 9-12; In English; See also 20010067671; Original contains color illustrations; Copyright Waived; Avail: CASI; A03, Hardcopy

The recent development of a smart structures module and its successful integration with a multidisciplinary design optimization software ASTROS and an Aeroservoelasticity (ASE) module is presented. Application examples have been worked out to demonstrate the integrated software capability. These include the neural net based active flutter suppression of a modeled F-16 wing using piezoelectric (PZT) actuators, the gust-load alleviation of a modeled F-18 aircraft using control surfaces, and trim drag reduction of TOMAHAWK with/without battle damage using PZT actuators.
Author

Piezoelectric Actuators; Multidisciplinary Design Optimization; Vibration Damping; Active Control; Computerized Simulation

20010067711 Dornier-Werke G.m.b.H., Friedrichshafen, Germany
ACTIVE FIN-BUFFETING ALLEVIATION FOR FIGHTER AIRCRAFT
Duerr, Johannes K., Dornier-Werke G.m.b.H., Germany; Herold-Schmidt, Ursula, Dornier-Werke G.m.b.H., Germany; Zaglauer, Helmut W., Dornier-Werke G.m.b.H., Germany; Becker, Juergen, DaimlerChrysler Aerospace A.G., Germany; Active Control Technology for Enhanced Performance Operational Capabilities of Military Aircraft, Land Vehicles and Sea Vehicles; June 2001, pp. 11-1 - 11-11; In English; See also 20010067671; Copyright Waived; Avail: CASI; A03, Hardcopy

Severe structural vibrations can be induced in tails of high performance aircraft flying at high angles of attack by vortices originating from wing/fuselage leading edge extensions. The resulting loads may lead to increased material fatigue and require an augmented effort in aircraft maintenance. A number of different concepts have been proposed to either avoid the excitation of the tail fin by bursting vortices or to dampen the resulting structural vibrations. In the early 1990s active system concepts were suggested as an efficient way for active buffet load alleviation. In order to investigate the performance of such systems a collaborative research project was initiated between DaimlerChrysler Aerospace - Military Aircraft Division, the German Aerospace Center (DLR), and DaimlerChrysler Research and Technology within the framework of the Advanced Aircraft Structures Program. Four concepts were investigated in detail within this project: (1) an active rudder; (2) an active auxiliary rudder; (3) a piezo-controlled interface; and (4) a system of surface-mounted or structurally integrated piezoelectric patch actuators. The feasibility of all these concepts could be proven and their performance could be assessed in an extensive theoretical analysis that involved the complete aircraft system, as well as in wind tunnel tests on the rudder concepts and, for the piezo-controlled concepts, in tests on a laboratory demonstrator that was conceived, designed and manufactured to be dynamically equivalent to a typical fighter aircraft fin. In addition, a materials qualification program was initiated in order to demonstrate the compatibility of structures with integrated piezoceramic actuators with the requirements imposed through the application in a modern fighter aircraft tail. In this way the maturity of this emerging new technology could be shown and an eventual demonstrator phase was prepared.
Author

Buffeting; Piezoelectric Actuators; Fins; Rudders; Active Control

20010067713 Georgia Inst. of Tech., School of Aerospace Engineering, Atlanta, GA USA
OFFSET PIEZOCERAMIC STACK ACTUATORS AND ACCELERATION FEEDBACK CONTROL FOR TAIL BUFFET ALLEVIATION OF A HIGH PERFORMANCE TWIN TAIL AIRCRAFT: ROBUSTNESS ISSUES
Hanagud, S., Georgia Inst. of Tech., USA; BayondeNoyer, M., Georgia Inst. of Tech., USA; Henderson, D., Air Force Research Lab., USA; Active Control Technology for Enhanced Performance Operational Capabilities of Military Aircraft, Land Vehicles and Sea Vehicles; June 2001, pp. 13-1 - 13-11; In English; See also 20010067671; Original contains color illustrations; Copyright Waived; Avail: CASI; A03, Hardcopy

In high performance twin-tail aircraft, tail buffet occurs when unsteady pressures associated with separated flow excite the modes of the vertical fin structural assemblies. At high angles of attack, flow separates and is convected by the geometry of the wing-fuselage interface toward the vertical tails. This phenomenon, along with the aeroelastic coupling of the tail structural assembly, results in vibrations that can shorten the fatigue life of the empennage assembly and limit the flight envelope due to the large amplitude of the fin vibrations. The objective of this paper is to present a control system for buffet alleviation by the use of Offset Piezoceramic Stack Actuators (OPSA) in combination with acceleration feedback control. The emphasis of this paper is placed on the reliability and maintainability of the actuator and the robustness of the controller. The choice of actuator and controller is justified. Methods for the design and the placement of the OPSAs for tail buffet alleviation are elaborated. A method to design the acceleration feedback controller for tail buffet alleviation is presented. Finally, experimental validations of the effectiveness and the robustness of the controller are performed on a full-scale vertical tail sub-assembly and on a 1/16th-scale wind tunnel model.
Author

Buffeting; Controllers; Tail Assemblies; Vibration; Piezoelectric Actuators; Wind Tunnel Tests

09
RESEARCH AND SUPPORT FACILITIES (AIR)

19990032461 Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Inst. fuer Flugmechanik, Brunswick, Germany
DATA BASE DEVELOPMENT FOR LEVEL D SIMULATORS: LESSONS LEARNED
Moennich, W., Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; Jategaonkar, R. V., Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; System Identification for Integrated Aircraft Development and Flight Testing; March 1999, pp. 14-1 - 14-8; In English; See also 19990032449; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

In the recent past aerodynamic data bases meeting the stringent accuracy requirements of Level D flight simulators have been generated at the DLR Institute of Flight Mechanics for two propeller aircraft, namely the C-160 military transport aircraft and the Dornier 328 commercial passenger transport aircraft. In the case of Dornier 328 having reversible flight controls, in addition to the rigid body aerodynamics, it was required to generate the hinge moment data base. Furthermore, it was also necessary to demonstrate the end-to-end match resulting from an integrated model with pilot's force inputs (i.e. 6-DOF equations of aircraft motion incorporating the identified aerodynamic data base coupled with the dynamic models of the flight control systems driven through pilot applied forces and incorporating the identified hinge moments data base). In contrast to the usual approach of demonstrating the adequacy based on a model driven through control surface inputs adopted in the case of C-160, the force driven models of the Dornier 328 turned out to be significantly more complex. This paper highlights the approach adopted for generating the data bases, the difficulties encountered in the data generation, and the lessons learned therefrom.
Author

Control Surfaces; Flight Control; C-160 Aircraft; Flight Simulators; Aircraft Models; Aerodynamics; Aircraft Design

19990068494 Marine Corps, Washington, DC USA
REFRESHER PHYSIOLOGY IN AIRCRAFT SIMULATORS (SIMPHYS)
Mason, R. P., Marine Corps, USA; Aeromedical Aspects of Aircrew Training; June 1999, pp. 18-1 - 18-2; In English; See also 19990068480; Copyright Waived; Avail: CASI; A01, Hardcopy; A01, Microfiche

The use of aircraft simulation in aviation training programs has increased significantly in recent years along with their capabilities and sophistication. Aircrew coordination training (ACT), aircraft systems checks, instrument rating checks, and emergency procedures training are currently being conducted in flight simulators. As flight simulator use and fidelity increases, the ability to replicate actual flight conditions and aeromedical safety issues are both enhanced. A simulator-based curriculum was developed by modifying the learning objectives from the existing rotary wing refresher aviation physiology and survival training curriculum to performance based objectives that could be demonstrated in a simulator-based curriculum, The AH-1W (Super Cobra) Weapons Systems Trainer (Device 2F136) at MCAS Camp Pendleton, CA was used as the simulator test bed. Fourteen pilots completed the prototype curriculum and were questioned on its

efficacy. All fourteen pilots identified the simulator-based curriculum as superior to the existing curriculum and as more effective in meeting the curriculum's learning objectives. Substantial increases across all learning domains were demonstrated and a change in the pilots' attitudes towards refresher physiology training was noted. A simulator-based rotary wing refresher aviation physiology and survival training curriculum is feasible and should be adopted to provide effective aeromedical training for aircrew. Further evaluation is on going to determine the potential and effectiveness of a fast jet and transport simulator-based curricula.
Author
Flight Simulators; Education; Flight Crews; Aerospace Medicine; Computerized Simulation

20000039705 Technische Hochschule, Institut fuer Raumfahrtsysteme, Stuttgart, Germany
DIAGNOSTIC TOOLS FOR PLASMA WIND TUNNELS AND REENTRY VEHICLES AT THE IRS
Auweter-Kurtz, Monika, Technische Hochschule, Germany; Feigl, Markus, Technische Hochschule, Germany; Winter, Michael, Technische Hochschule, Germany; Measurement Techniques for High Enthalpy and Plasma Flows; April 2000, pp. 2B-1 - 2B-78; In English; See also 20000039703; Copyright Waived; Avail: CASI; A05, Hardcopy

Various plasma wind tunnels have been built for developing reusable space transportation systems and space probes entering the atmospheres of celestial bodies. All together they cover almost the whole reentry trajectory of a space craft. They generate continuous plasma flows of high specific enthalpy and velocity with thermal or magnetoplasmadynamic generators. Plasma wind tunnels are used for: (1) development and qualification of radiation and ablative cooling materials and thermal protection systems, (2) validation of numerical codes for reentry prediction, and (3) development and qualification of reentry measurement devices. The accuracy of the simulation of reentry conditions strongly depends on the ability to determine the flow conditions. These three lectures give an overview of the diagnostic methods which are qualified and in use at the IRS. Both intrusive probe measurement techniques (part A) including mass spectrometry and non-intrusive, optical techniques (part B) such as emission spectroscopy and laser induced fluorescence (LIF) are used to investigate high enthalpy plasma flows. Several measurement techniques are being developed for flight application (see part C). The minimum set of parameters which have to be duplicated during the tests for material qualification are the specific enthalpy of the gas, the stagnation pressure and the surface temperature in the case of a radiation cooling material, or the heat flux for an ablative material. This is a minimum set of parameters which has to be adjusted during the test. A whole series of probes and non-intrusive techniques were developed to determine these parameters. The average specific enthalpy of the flow in the exit plane of the plasma generator nozzle can be derived for all kinds of plasma wind tunnels by an energy balance. Therefore, the electric power consumed by the plasma source, the mass flow rate and the heat losses within the plasma generator are measured. The average specific enthalpy at the end of the plasma generator is then derived as the difference of the electrical power and the total heat loss related to the mass flow rate.
Author
Emission Spectra; Laser Induced Fluorescence; Magnetohydrodynamic Flow; Mathematical Models; Nonintrusive Measurement; Thermal Protection; Wind Tunnels; Simulation

20000039708 Rouen Univ., Centre National de la Recherche Scientifique, France
OVERVIEW OF MEASUREMENT TECHNIQUES AT CORIA
Robin, L., Rouen Univ., France; Boubert, P., Rouen Univ., France; Bourdon, A., Rouen Univ., France; Bultel, A., Rouen Univ., France; vanOotegem, B., Rouen Univ., France; Vervisch, P., Rouen Univ., France; Measurement Techniques for High Enthalpy and Plasma Flows; April 2000, pp. 4A-1 - 4A-14; In English; See also 20000039703; Copyright Waived; Avail: CASI; A03, Hardcopy

At CORIA, three wind tunnels have been built up to simulate reentry conditions of different planetary atmospheres. They have been implemented by numerous optical and probe measurement techniques to carry out flow parameters to improve understanding of the aerodynamic behavior and chemical processes.
Author
Wind Tunnels; Fabrication; Aerodynamic Characteristics; Flow Characteristics; Optical Measurement

20000039718 Technische Hochschule, Institut fuer Raumfahrtsysteme, Stuttgart, Germany
OVERVIEW OF IRS PLASMA WIND TUNNEL FACILITIES
Auweter-Kurtz, Monika, Technische Hochschule, Germany; Wegmann, Thomas, Technische Hochschule, Germany; Measurement Techniques for High Enthalpy and Plasma Flows; April 2000, pp. 2A-1 - 2A-20; In English; See also 20000039703; Copyright Waived; Avail: CASI; A03, Hardcopy

Upon entering the atmosphere of celestial bodies, spacecrafts encounter gases at velocities of more than ten km/s, thereby being subjected to great heat loads. The Artist's concept of X-38 reentering Earth's atmosphere are shown. The X-38 is a technology demonstrator for the proposed Crew Return Vehicle (CRV), which will be designed for an emergency return from the International Space Station.
Derived from text
Celestial Bodies; Proving; X-38 Crew Return Vehicle; Temperature Effects; Reentry Vehicles

20010056521 Air Force Research Lab., Wright-Patterson AFB, OH USA
SIMULATION
Albery, W., Air Force Research Lab., USA; Human Consequences of Agile Aircraft; May 2001, pp. 111-120; In English; See also 20010056513; Original contains color illustrations; Copyright Waived; Avail: CASI; A02, Hardcopy

Supermaneuverable flight is characterized by high angle-of-attack flight and motion in the longitudinal, or x (chest-to-back), lateral y (side-to-side), and vertical, or z (head-to-toe) axes. These three aircraft axes are shown. The high agility flight environment is also characterized by slightly lower +Gz levels, shorter +Gz durations, very high G onset rates, high angular rates, and multiple axis G stress as compared to the conventional fighter environment. Only a few jet aircraft are currently capable of this type of flight. Those aircraft that are equipped with thrust-vectoring jet engines (Su-27, Su-37, Harrier, X-31, F-22) are capable of directing thrust in a direction other than along the longitudinal axis of the aircraft. By directing the thrust up and down, the aircraft becomes agile in the pitch axis. The F-22 has pitch axis thrust-vectoring. When the thrust is directed laterally, an aircraft has the capability to yaw while traversing along a longitudinal velocity vector. The X-31 has both pitch and yaw axis thrust vectoring. Maximum G levels, angular velocities, and angular accelerations of supermaneuverable aircraft are shown.
Author
Flight Simulation; Flight Conditions; Thrust Vector Control

14
GROUND SUPPORT AND FACILITIES (SPACE)

20010072762 Army Simulation Centre, Land Force Doctrine and Training System, Kingston, Ontario Canada
THE ESTABLISHMENT OF THE ARMY SIMULATION CENTRE
Cyr, J. L., Army Simulation Centre, Canada; The Second NATO Modelling and Simulation Conference; July 2001, pp. 3-1 - 3-14; In English; See also 20010072746; Original contains color illustrations; Copyright Waived

It is the Army Simulation Center's (ASC) mission to provide simulation environment support to Army operations, combat development, and training, to assist in the development and validation of combat development solutions for the Army in the conduct of operations throughout the spectrum of conflict, and to provide demanding and realistic battle simulation to support the training of land force command units and formations.
Derived from text
Computerized Simulation; Training Devices; Environment Simulation

20010072763 Italian Joint Operations Headquarters, Simulation Div., Rome, Italy
ITALIAN M AND S CENTER PROJECT
Surian, Alvino, Italian Joint Operations Headquarters, Italy; The Second NATO Modelling and Simulation Conference; July 2001, pp. 5-1 - 5-59; In English; See also 20010072746; Original contains color illustrations; Copyright Waived

The Joint Operational Modeling and Simulation Center (CIMSO) is a project in the framework of the new Italian operations conduct concept. This short presentation will give you an overview of the work related to the project and its latest update. To describe the work done the presentation will focus on why Italy decided to adopt a simulation system to solve military problems, when the definition process started, what CIMSO will be, where we are and what we are doing, and how we intend to use the system during the first period of its employment.
Derived from text
Computerized Simulation; Environment Simulation; Systems Management

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SPACECRAFT DESIGN, TESTING AND PERFORMANCE

20010012825 Alenia Spazio S.p.A., Remote Sensing Engineering, Rome, Italy
CONSTELLATION ORBIT DESIGN CRITERIA FOR A DUAL USE EO SYSTEM
Spera, P., Alenia Spazio S.p.A., Italy; Gallon, A., Alenia Spazio S.p.A., Italy; Space-Based Observation Technology; October 2000, pp. 13-1 - 13-10; In English; See also 20010012824; Original contains color illustrations; Copyright Waived; Avail: CASI; A02, Hardcopy

In this paper the work concerning the definition of specific criteria for the orbit design of a Dual Use Earth Observation satellite constellation is presented. These criteria have been derived by considering a wide range of civilian applications (e.g. risks management, agriculture/forestry, marine/coastal, geology) and military applications (surveillance, intelligence, crisis management, mission planning). In fact, for each of the application areas and the relevant Earth Observation(EO) products, a list of specific observation constraints have been identified and discussed in order to address optimal solutions allowing the timely generation of products characterized. by a high level of quality and information content. On the other hand, implementation/operational constraints and system complexity evaluation have been also considered in the constellation design process. From the identification of candidate specialized orbits (elliptical orbits, inclined orbits and circular orbits) a specific system level trade-off has been performed in order to identify the best satellite constellation configuration in terms of orbit type, orbit planes, satellite phasing which allows to maximize the main performances (coverage and revisit times) for a given number of operational satellites. This trade-off takes into account the payload type (i.e. optical or SAR), the payload characteristics and constraints (e.g. Field of view, resolution, dimension, power demand, illumination condition, interferometric capabilities and system complexity), the payload operational modes and spacecraft limitations due to drag effects and propulsion. A detailed parametric analysis will be provided by showing the relationships between the system performances and the main design drivers.
Derived from text
Design Analysis; Satellite Constellations; Satellite Observation; Systems Analysis

20010012829 Air Force Office of Scientific Research, Bolling AFB, Washington, DC USA
AN INNOVATIVE APPROACH TO SATELLITE TECHNOLOGY
Janni, Joseph F., Air Force Office of Scientific Research, Bolling AFB, USA; King, Yolanda Jones, Air Force Office of Scientific Research, Bolling AFB, USA; Witt, Gerald, Air Force Office of Scientific Research, Bolling AFB, USA; Space-Based Observation Technology; October 2000, pp. 17-1 - 17-7; In English; See also 20010012824; Copyright Waived; Avail: CASI; A02, Hardcopy

Innovation and rapid prototyping using advanced technologies are the hallmarks of new initiatives coming from the USAF Research Laboratory's Office of Scientific Research (AFOSR). University Nanosatellite Program AFOSR, in conjunction with DARPA, is sponsoring ten universities, formed into small teams and challenged with paving the way to novel space capabilities. The satellites leverage innovative thinking within our universities, leading to flight experiments of state-of- technologies and advanced mission concepts. Experiments range from micro-propulsion to formation flying. These miniaturized satellites will be prototyped and launched. We describe the philosophy, approach, and results to date of the program. TechSat21 Program. Recent progress in the miniaturization of key satellite technologies enables innovative solutions for space missions. AFOSR, in Conjunction with ARFL'S Space Vehicles Directorate, has developed the TechSat 21 program. This low-cost, lightweight cluster of cooperating microsatellites may eventually replace today's heavy and more expensive systems. Each microsatellite will communicate with other members of the cluster to share information and mission functions, thus comprising a 'virtual' satellite. TechSat 21 offers the flexibility to incorporate cutting edge technology in a reconfigurable constellation. This unusual approach offers multimission capability as well as a reduced life cycle cost. It is envisioned that new technology may be inserted by replacing members of the cluster with enhanced versions. Research and technology investments include sparse aperture sensing, local communications in space and microsatellite bus technologies. The investment in innovative. basic research areas to make TechSat 21 a viable alternative as well as the overall program approach will be covered. Many of the techniques and technologies being demonstrated in the University Satellite program have application to the TechSat2l program.
Derived from text
Microsatellites; Microminiaturization; Small Satellite Technology; Nanosatellites

20010012830 Air Force Research Lab., Space Vehicles Directorate, Kirkland AFB, NM USA
THE PRODUCTION OF CONTAMINATION ON SPACECRAFT SURFACES BY HYPERVELOCITY DEBRIS IMPACTS
Stein, Charles, Air Force Research Lab., USA; Roybal, Robert, Air Force Research Lab., USA; Tlomak, Pawel, Air Force Research Lab., USA; Space-Based Observation Technology; October 2000, pp. 19-1 - 19-6; In English; See also 20010012824; Copyright Waived; Avail: CASI; A02, Hardcopy

A study of the mechanical damage and the contamination produced by hypervelocity debris impacts on spacecraft was conducted in a space chamber capable of accelerating debris simulating particles to 7.5 km/sec and other components of the Low Earth Orbit environment. Damage characteristics and the nature and extent of contamination generated by the impact of 3 mm diameter, 3 micron thick aluminum particles, accelerated to 4.5 km/s, were investigated. Scanning electron microscopy, optical microscopy, and spectrophotometry were used to measure the mechanical damage and the loss of transmission through solar photovoltaic cover glass materials.
Author
Damage; Damage Assessment; Contamination; Debris

19
SPACECRAFT INSTRUMENTATION AND ASTRIONICS

20000012175 Kuznetsov Research Inst. of Applied Mechanics, Moscow, Russia
GYROSCOPIC INSTRUMENTS FOR THE RUSSIAN SEGMENT ATTITUDE DETERMINATION SYSTEM OF THE INTERNATIONAL SPACE STATION ALPHA
Kazakov, B. A., Kuznetsov Research Inst. of Applied Mechanics, Russia; Kharlamov, S. A., Kuznetsov Research Inst. of Applied Mechanics, Russia; Mezentsev, A. P., Kuznetsov Research Inst. of Applied Mechanics, Russia; Reshetnikov, V. I., Kuznetsov Research Inst. of Applied Mechanics, Russia; Sapozhnikov, I. N., Kuznetsov Research Inst. of Applied Mechanics, Russia; 6th Saint Petersburg International Conference on Integrated Navigation Systems; October 1999, pp. 3-1 - 3-6; In English; See also 20000012172; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

There are several sets of gyroscopic instruments measuring the attitude of the Service Module and Functional Cargo Module which constitute the Russian segment of the International Space Station

Alpha. This report presents some important details of the development of the precision gyroscopic instruments, the contribution of which in the ISSA (International Space Station Alpha) attitude accuracy have the primary significance. The main performance characteristics of gyroscopic instruments are discussed such as the accuracy (the ultimate bias drift uncertainty less than 0.003 deg/hour), service life (more than 10 years), and high reliability.
Author
International Space Station; Gyroscopes; Attitude Control; Inertial Navigation; Service Modules

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SPACECRAFT PROPULSION AND POWER

20010012828 European Office of Aerospace Research and Development, Space Technology, London, UK
THE EUROPEAN OFFICE OF AEROSPACE RESEARCH AND DEVELOPMENT'S SMALL SATELLITE PROPULSION SYSTEM RESEARCH PROGRAM
Lawrence, Timothy J., European Office of Aerospace Research and Development, UK; Space-Based Observation Technology; October 2000, pp. 16-1 - 16-8; In English; See also 20010012824; Copyright Waived; Avail: CASI; A02, Hardcopy

A spacecraft needs propulsion for attitude control, stationkeeping, and orbit maneuvering. Traditionally, these needs have been satisfied by the following systems options: Cold-gas propulsion - mainly using nitrogen for attitude control; Hydrazine-based systems - for attitude control, station-keeping and orbit maneuvering; and solid rockets - for orbits maneuvering. However, the space industry trend to build smaller and cheaper spacecraft (10-300 kg) have created propulsion system integration requirements and constraints unique to these niche applications. The European Office of Aerospace Research and Development (EOARD) has started a program with 3 European institutes to investigate these niche systems for future Air Force small satellite propulsion missions. This paper will go into greater description of these programs and will conclude with future work planned.
Author
Propulsion System Configurations; Spacecraft Propulsion; Attitude Control; Stationkeeping; Maneuvers

20010067724 Georgia Inst. of Tech., Schools of Aerospace Engineerin, Mechanical and Electrical and Computer Engineering, Atlanta, GA USA
ACTIVE CONTROL OF COMBUSTOR PROCESSES
Zinn, B. T., Georgia Inst. of Tech., USA; Allen, M. G., Georgia Inst. of Tech., USA; Glezer, A., Georgia Inst. of Tech., USA; Jagoda, J. I., Georgia Inst. of Tech., USA; Neumeier, Y., Georgia Inst. of Tech., USA; Seitzman, J. M., Georgia Inst. of Tech., USA; Active Control Technology for Enhanced Performance Operational Capabilities of Military Aircraft, Land Vehicles and Sea Vehicles; June 2001, pp. 6-1 - 6-16; In English; See also 20010067671
Contract(s)/Grant(s): F49620-99-1-0142; DE-FC21-92MC-29061; DAAH04-96-1-0008; Copyright Waived; Avail: CASI; A03, Hardcopy

This paper describes results of several studies of sensors, actuators, and control systems for active control of combustor processes. First, the paper discusses the performance of an adaptive active control system (ACS) for controlling detrimental combustion instabilities. This ACS consists of an observer that determines the time dependent characteristics of the instability in real time, an adaptive controller and a fuel injector actuator. During control, the controller sends a time varying signal to the actuator and the corresponding system's response is determined by the observer in practically real time. These data are then used to determine the optimum control parameters. Results obtained in several studies demonstrate that this ACS can rapidly and effectively damp combustion instabilities without apriori knowledge of the characteristics of the instability. The second part of the paper discusses two open loop applications of synthetic jets (SJ) aimed to improve combustor mixing processes. The third part describes a study of the possibility of using an internally mixed fuel atomizer to control the spray characteristics; i.e., independently control the spray's flow rate and mean droplet diameter. The last part of the paper discusses the development of a wireless, MEMS scale, pressure transducer for high temperature applications, e.g., gas turbines compressors and combustors. The developed pressure transducer is constructed of high temperature ceramic liners that are used in electronic packaging. Using appropriate construction, a cavity is formed between two external liners, resulting in a device that behaves as a capacitor. The capacitor is connected to an inductor that is 'deposited' on one of its external liners to form an LC circuit with a specific resonant frequency. When a change in pressure deforms one (or both) of the external liners, the system's capacitance and, thus, resonant frequency change. This frequency change is sensed by an 'external' antenna and is 'related' to the pressure change, thus providing means for determining the pressure and its wireless transmission.
Author
Active Control; Combustion Stability; Real Time Operation; Pressure Sensors

20010067725 Ecole Centrale de Paris, Lab.E.M2.C, France
NUMERICAL SIMULATION OF ADAPTIVE CONTROL APPLICATION TO UNSTABLE SOLID ROCKET MOTORS
Mettenleiter, M., Ecole Centrale de Paris, France; Vuillot, F., Office National d'Etudes et de Recherches Aerospatiales, France; Candel, S., Ecole Centrale de Paris, France; Active Control Technology for Enhanced Performance Operational Capabilities of Military Aircraft, Land Vehicles and Sea Vehicles; June 2001, pp. 7-1 - 7-14; In English; See also 20010067671; Copyright Waived; Avail: CASI; A03, Hardcopy

This article describes current developments in the numerical simulation of active control. The objective of this investigation is to devise software tools for the development of active control. The present approach uses a numerical simulation of the system based on the Navier-Stokes equations. It differs from the more standard simulations relying on lower order dynamical models. The main difficulties associated with the present strategy are related to the representation of the actuator in the flow simulation module and with the interfacing of this module with the adaptive control routine. These issues require careful treatment to obtain a suitable numerical model of flow control. It is first shown that the actuator may be described by a distribution of sources in the field. The time stepping needed by the flow simulation module and by the control unit differ widely (the ratio between the time steps is of the order of 100 or more). This constitutes a source of perturbation and it may introduce unwanted high frequency components in the flow simulation. It is shown that this problem is alleviated by placing numerical filters at the controller input and output. A set of calculations are carried out to simulate vortex shedding instabilities of a simplified solid propellant rocket. These instabilities are then adaptively controlled. This example serves to illustrate the simulation methodology and provides insights into the operation of the flow controller.
Author
Active Control; Computerized Simulation; Flow Visualization

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COMPOSITE MATERIALS

20000032863 Pisa Univ., Dept. of Aerospace Engineering, Italy
DAMAGE TOLERANCE CHARACTERISTICS OF COMPOSITE SANDWICH STRUCTURES
Lazzeri, L., Pisa Univ., Italy; Mariani, U., Agusta S.p.A., Italy; Application of Damage Tolerance Principles for Improved Airworthiness of Rotorcraft; February 2000, pp. 4 - 1 - 4 - 6; In English; See also 20000032859; Copyright Waived; Avail: CASI; A02, Hardcopy

Current damage tolerance requirements impose strict constraints on the design of composite aircraft structures, since the various forms of defects taken into consideration must show 'no-growth' characteristics in the environmental and loading conditions expected in the operative life. A research activity was carried out by Agusta, in collaboration with the University of Pisa, with the purpose of assessing the damage tolerance characteristics of typical composite sandwich structures used by the helicopter industry. A particular effort was dedicated to the study of delamination growth under compression loading, a basic step for understanding the damage tolerance behaviour of composite structures. The results of the numerical analysis carried out show that G, the Strain Energy Release Rate, is a suitable parameter for describing the behaviour of

the delamination, but it is essential to consider its partition according to the fundamental modes.
Author
Helicopter Design; Aircraft Structures; Composite Structures; Damage; Delaminating; Helicopters; Sandwich Structures; Tolerances (Mechanics)

20000032864 Imperial Coll. of Science, Technology and Medicine, Dept. of Aeronautics, London, UK
DAMAGE TOLERANCE TO LOW VELOCITY IMPACT OF LAMINATED COMPOSITES
Davies, G. A. O., Imperial Coll. of Science, Technology and Medicine, UK; Hitchings, D., Imperial Coll. of Science, Technology and Medicine, UK; Zhang, X., Imperial Coll. of Science, Technology and Medicine, UK; Application of Damage Tolerance Principles for Improved Airworthiness of Rotorcraft; February 2000, pp. 6 - 1 - 6 - 13; In English; See also 20000032859; Sponsored in part by British Aerospace (Military and Aerostructure); Copyright Waived; Avail: CASI; A03, Hardcopy

A strategy is developed for predicting easily the threshold energy for delamination caused by impact, whatever the nature of the laminated structure. The actual delamination and fiber damage is also predicted and the consequent compression-after-impact strengths. The latter strategies may be approximate but current research is pointing the way to more accurate solutions based on finding energy-release-rates around the delamination front.
Author
Delaminating; Tolerances (Mechanics); Impact Damage; Aircraft Structures; Composite Structures; Impact Resistance

20000032867 Eurocopter Deutschland G.m.b.H., Munich, Germany
FATIGUE SUBSTANTIATION AND DAMAGE TOLERANCE EVALUATION OF FIBER COMPOSITE HELICOPTER COMPONENTS
Bansemir, H., Eurocopter Deutschland G.m.b.H., Germany; Emmerling, S., Eurocopter Deutschland G.m.b.H., Germany; Application of Damage Tolerance Principles for Improved Airworthiness of Rotorcraft; February 2000, pp. 11 - 1 -11 - 11; In English; See also 20000032859
Report No.(s): ECD-0096-99-PUB; Copyright Waived; Avail: CASI; A03, Hardcopy

Helicopter rotor systems are dynamically loaded structures with many composite components such as main and tail rotor blades and rotor hubs. The new civil helicopter EC135 has a bearingless main rotor system certified according to the 'Special Condition for Primary Structures Designed with Composite Material' of the German airworthiness authority LBA containing increased safety demands. This special condition addresses subjects like: demonstration of ultimate load capacity including consideration of manufacturing and impact damages; fatigue evaluation for parts suitable or unsuitable for damage tolerance method and the related inspection procedures; investigation of growth rate of damages that may occur from fatigue, corrosion, intrinsic, and manufacturing defects or damages from discrete sources under repeated loads expected in service; residual strength requirements; consideration of the effects of material variability and environmental conditions like hot/wet strength degradation etc.; and substantiation of bonded joints. The fatigue tolerance evaluation and damage tolerance substantiation for composite structures are shown in this paper. The fulfillment of the 'Special Conditions' is demonstrated for the main rotor blade of the ECl35. T'he fatigue tolerance evaluation and damage tolerance sub- stantiation for composite structures are shown in this paper. The fulfillment of the 'Special Conditions' is demonstrated for the main rotor blade of the EC 135.
Author
Aircraft Reliability; Composite Materials; Composite Structures; Damage; Degradation; Fiber Composites; Helicopters; Impact Damage; Rotary Wings; Tolerances (Mechanics); Fatigue (Materials); C-135 Aircraft

20000039717 Academy of Sciences (USSR), Inst. for Problems in Mechanics, Moscow, USSR
METHODOLOGY, TECHNICAL APPROACH AND MEASUREMENT TECHNIQUES FOR TESTING OF TPM THERMAL PROTECTION MATERIALS IN IPM PLASMATRONS
Gordeev, A. N., Academy of Sciences (USSR), USSR; Measurement Techniques for High Enthalpy and Plasma Flows; April 2000, pp. 1B-1 - 1B-13; In English; See also 20000039703; Copyright Waived; Avail: CASI; A03, Hardcopy

An induction plasmatron application for testing of thermal protection materials is discussed in presented paper on the basis of 35-years experience of Plasma Laboratory of IPM RAS. Methodology of testing of thermal protection materials in plasmatrons was based on simulation of hypersonic reentry heating near stagnation point using subsonic plasma jets, possibility to regulate pressure and flow enthalpy smoothly and independently of one another and the using of plasmatronS advantages such as purity of plasma flow, its high stability and reproducibility as well as wide ranges of realized pressure and heat flux. Purity of plasma flow allows to fulfill long-term aging tests (up to 100 15-minute testing cycles for one sample) at excellent stability and reproducibility flow parameters. Conventional techniques of measurements and analysis such as pyrometry, SEM etc. are discussed together with developed approach to study of thermochemical stability of materials using complex application of optical spectral analysis, tests in different gases and methods of post test analysis.
Author
Procedures; Heat Flux; Long Term Effects; Purity; Reentry Effects; Spectrum Analysis; Temperature Measurement; Thermal Protection; Thermochemistry

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INORGANIC, ORGANIC AND PHYSICAL CHEMISTRY

19990102973 Cranfield Univ., Dept. of Automotive, Combustion and Energy Engineering, Bedford, UK
PLANAR MEASUREMENTS OF FUEL VAPOUR, LIQUID FUEL, LIQUID DROPLET SIZE AND SOOT
Greenhalgh, Douglas A., Cranfield Univ., UK; Planar Optical Measurement Methods for Gas Turbine Components; September 1999, pp. 7-1 - 7-18; In English; See also 19990102970; Original contains color illustrations
Contract(s)/Grant(s): CEC-AER2-CT92-0036; EPSRC-GR/H78238; EPSRC-GR/K37215; Copyright Waived; Avail: CASI; A03, Hardcopy; A02, Microfiche; US Distribution and Sales Only

The design of combustors requires high combustion efficiency with both low NO(x) and low soot emissions coupled to reliable ignition and good weak stability. Fuel placement resulting from fuel injection is critical to all these factors. In most combustors the fuel enters as a liquid and its subsequently evaporated and burn. Diagnostics, which can readily map the patternation of liquid and vapour phases of fuel, are therefore of immense practical value to the combustor engineer. In addition the performance of the atoml'ser can be assessed through the resulting droplet size. This paper introduces and describes two laser sheet imaging methods for the measurement of fuel in its liquid and vapour phases (LIF or Laser Induced Fluorescence and LSD or Laser Sheet dropsizing) and a method for imaging soot, namely LII or laser Induced Incandescence.
Author
Diagnosis; Drop Size; Imaging Techniques; Soot; Nitrogen Oxides; Vapor Phases; Ignition

20000020833 General Electric Co., Combustion Center of Excellence, Cincinnati, OH USA
EMPIRICAL AND ANCHORED METHODOLOGIES FOR CONTROLLING COMBUSTION DYNAMICS
Pandalai, Raghavan P., General Electric Co., USA; Hsiao, George C., General Electric Co., USA; Mongia, Hukam C., General Electric Co., USA; Gas Turbine Engine Combustion, Emissions and Alternative Fuels; June 1999, pp. 5-1 - 5-14; In English; See also 20000020829; Copyright Waived; Avail: CASI; A03, Hardcopy; A06, Microfiche

This paper describes the empirical and anchored methodologies developed at General Electric Aircraft Engines (GEAE) to control combustion dynamics in aircraft and aero-derivative industrial turbine engine combustion systems. Combustion instability problems in aircraft and more recently in aero-derivative industrial engine

combustors have been a serious problem during development, and in some production engines. The conventional approach to this problem has been based largely on empirical correlations and design experience. The advent of low emissions combustors for aircraft and industrial applications which incorporate several innovative technologies have put additional pressures to look at this problem from a more fundamental viewpoint so as to identify a dynamics 'fix' quickly based on root cause, and minimum testing to demonstrate the fix. To achieve this goal, a physics based combustion dynamics model is developed and described in this paper. The acoustic abatement technology that has made an optimum use of both the passive and active control technique (hybrid control system) employed in GEAE's product lines consistent with customers' needs has also been integrated into this model. The formulation of the dynamics model is based on the exact solution of the acoustic wave equation and is capable of incorporating several features unique to gas turbine combustors. The current approach is built on an acoustic based framework and the total combustion system from compressor exit to first stage turbine nozzle including fuel delivery system, fuel premixer and acoustic damping devices are incorporated into this model because of their impacts on overall dynamics. Engine test data obtained during the development phase of GEAE's ultra low emission industrial engine combustor development program was used to demonstrate the feasibility of the model and the anchored approach. The predicted trends not only agreed very well with test data, but also demonstrated the capability of the model to distinguish between acoustically active and inactive regimes of operation.
Author
Gas Turbine Engines; Combustion Stability; Aircraft Engines; Combustion Physics; Engine Design; Mathematical Models

20000020834 Motoren- und Turbinen-Union G.m.b.H., Munich, Germany
NO(X) REDUCTION BY LEAN PREMIXED PREVAPORIZED COMBUSTION
Ripplinger, T., Motoren- und Turbinen-Union G.m.b.H., Germany; Zarzalis, N., Motoren- und Turbinen-Union G.m.b.H., Germany; Meikis, G., Motoren- und Turbinen-Union G.m.b.H., Germany; Hassa, C., Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; Brandt, M., Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; Gas Turbine Engine Combustion, Emissions and Alternative Fuels; June 1999, pp. 7-1 - 7-12; In English; See also 20000020829
Contract(s)/Grant(s): BMBF-0326782D/215; Copyright Waived; Avail: CASI; A03, Hardcopy; A06, Microfiche

A low emission working by lean combustion with premixing and prevaporizing of liquid fuel is presented for aero jet engine and power generation applications. A model rectangular combustor was designed and manufactured as a portion from a full annular combustor and investigated in medium- and high-pressure tests at burner inlet temperatures up to 820 K and at operating pressures up to 20 bar. The design of the combustor was supported by 3D CFD calculations, which were conducted in order to optimise the flow field within the combustor, especially with a view to creating a sufficient recirculation zone for flame stabilization. In addition to the combustor tests, investigations were carried out with the two phase flow within the premixer by means of optical measuring techniques at the German Aerospace Research Establishment (DLR Cologne). With the present design of the premixing duct and the airblast atomizer the liquid fuel can almost be completely evaporated within a premixing length of 150 mm, corresponding to a residence time of the fuel/air mixture in the premixer of 1.25 - 1.5 ms. The model combustor was operated at burner inlet temperatures of up to 820 K and at operating pressures of up to 20 bar with no autoignition of the fuel/air mixture within the premixing duct or flash back of the flame into the premixer occurring. The combustor combines very low NO(x) emissions (up to 85 % less NO(x) than a low NO(x) diffusion combustor) with high combustion efficiencies (above 99 % and a sufficient stability range (Phi(min.,Primary) = 0.5). Therefore, the present LPP concept provides a promising configuration for an ultra low NO(x) combustor, both for aero engine and power generation applications.
Author
Nitrogen Oxides; Aircraft Engines; Combustion; Combustion Products; Emission; Prevaporization; Premixing; Two Phase Flow

20000020835 South Carolina Energy Research and Development Center, Advanced Gas Turbine Systems Research, Clemson, SC USA
STATUS OF CATALYTIC COMBUSTION R AND D FOR THE DEPARTMENT OF ENERGY ADVANCED TURBINE SYSTEMS PROGRAM
Fant, D., South Carolina Energy Research and Development Center, USA; Jackson, G., Maryland Univ., USA; Karim, H., Precision Combustion, Inc., USA; Newburry, D., Siemens Westinghouse Power Corp., USA; Dutta, P., Solar Turbines, USA; Smith, K., Solar Turbines, USA; Smith, D., Rolls-Royce Allison, USA; Dibble, R., California Univ., USA; Gas Turbine Engine Combustion, Emissions and Alternative Fuels; June 1999, pp. 8-1 - 8-15; In English; See also 20000020829; Copyright Waived; Avail: CASI; A03, Hardcopy; A06, Microfiche

This paper discusses paper discusses some of the advanced concepts and fundamental R&D needs associated with implementing catalytic combustion systems to achieve ultra-low NO(x) emissions in the next generation of land-based gas turbine engines. In particular, the paper presents the development status and current design challenges being addressed by Siemens Westinghouse Power Corporation, Solar Turbines, and Rolls-Royce Allison, as part of the U.S. Department of Energy's (DOE) Advanced Turbine Systems (ATS) program. In addition, issues on catalytic combustion economics, durability and operability will be highlighted.
Author
Gas Turbine Engines; Catalysis; Combustion; Nitrogen Oxides; Emission

20000020839 Universidad Politecnica de Madrid, Madrid, Spain
REDUCED KINETIC MECHANISMS FOR MODELLING LPP COMBUSTION IN GAS TURBINES
Linan, A., Universidad Politecnica de Madrid, Spain; Bollig, M., Universidad Politecnica de Madrid, Spain; Sanchez, A. L., Universidad Carlos 3 de Madrid, Spain; Lazaro, B., Sener S.A., Spain; Gas Turbine Engine Combustion, Emissions and Alternative Fuels; June 1999, pp. 12-1 - 12-10; In English; See also 20000020829
Contract(s)/Grant(s): CEC-BRPR-CT95-0122; CICYT-C95013002; Copyright Waived; Avail: CASI; A02, Hardcopy; A06, Microfiche

Lean premixed methane-air flames are investigated in an effort to facilitate the numerical description of CO and NO emission in LPP (lean premixed prevaporized) combustion systems. Starting with a detailed chemistry description that includes 195 elementary steps, sensitivity procedures and steady-state approximations are introduced to obtain two different four-step reduced mechanisms, which employ either H or OH as the intermediate representing the radical-pool evolution. The resulting reduced mechanisms are especially well suited to describe high-pressure, lean premixed combustion. Based on the resulting flame structures, and following previous analyses, the mechanism is further simplified to give a two-step description, in which fuel is consumed and CO is produced according to the fast overall step CH4 + (3/2)O2 yields CO + 2H2O, while CO is slowly oxidized according to the overall step CO + (1/2)O2 yields CO2. Because of its associated fast rate, fuel consumption takes place in thin layers, while CO oxidation occurs downstream in a distributed manner, in a region where CO is the only intermediate not in steady state. In this two-step description, the rate of fuel consumption is assigned a heuristic Arrhenius dependence that adequately reproduces laminar burning velocities, whereas the rate of CO oxidation is extracted from a reduced chemistry analysis. Preliminary results corresponding to one-dimensional unstrained flames indicate that the formulation reproduces well flame structures, including profiles of CO, temperature and radicals. The accuracy of the resulting profiles suggests that the proposed formulation can also be used to calculate NO emissions by appending the appropriate chemistry. Although methane is employed in the present study as a model fuel, the universal structure of the resulting CO oxidation region, independent of the fuel considered, enables the proposed formulation to be readily extended to other hydrocarbons.
Author
Gas Turbines; Carbon Monoxide; Nitrogen Oxides; Premixed Flames; Exhaust Emission; Combustion; Methane; Premixing

20000020841 Centre National de la Recherche Scientifique, Lab. de Combustion et Systemes Reactifs, Orleans, France
KEROSENE COMBUSTION MODELLING USING DETAILED AND REDUCED CHEMICAL KINETIC MECHANISMS

Cathonnet, M., Centre National de la Recherche Scientifique, France; Voisin, D., Centre National de la Recherche Scientifique, France; Etsouli, A., Centre National de la Recherche Scientifique, France; Sferdean, C., Centre National de la Recherche Scientifique, France; Reuillon, M., Centre National de la Recherche Scientifique, France; Boettner, J. C., Centre National de la Recherche Scientifique, France; Dagaut, P., Centre National de la Recherche Scientifique, France; Gas Turbine Engine Combustion, Emissions and Alternative Fuels; June 1999, pp. 14-1 - 14-9; In English; See also 20000020829; Copyright Waived; Avail: CASI; A02, Hardcopy; A06, Microfiche

The growing cost of experimental tests in aircraft combustors and the efforts to reduce development time, lead combustor designers to develop computer programs in order to predict the performances of the combustors. The contribution made by these calculation methods has become all the more important, given that the increase in severity in military engine cycle and requirements for reducing pollution in civil aircrafts needed different types of combustor structure to be designed. In many of these combustion models, chemical kinetics is reduced to a single-step empirical expression or to global multistep schemes. However, a better knowledge of the chemistry of combustion is essential for the quality of the prediction of many important phenomena like ignition delays, flame speed, blow-out, engine efficiency and pollutant emissions. Therefore, several studies in the field of chemical kinetics have been devoted to the conception of reaction mechanisms with growing complexity for the representation of kerosene oxidation. In a previous study on kerosene oxidation in a jet-stirred reactor at atmospheric pressure, a quasi-global model was proposed to reproduce the concentration profiles of the major chemical species. Unfortunately, quasi-global mechanisms cannot be used in the whole range of operating conditions of a combustion chamber. In fact, the validity domain of chemical kinetic schemes in terms of temperature, pressure and equivalence ratio has to be large enough in order to include the wide range of operating conditions of modern combustors. This is particularly true for the prediction of carbon monoxide and unburned hydrocarbons which are intermediate products of combustion mainly at low ratings, or for the prediction of nitrogen oxides which are mostly produced at high temperature and pressure. Because of the superiority of detailed chemical kinetic mechanisms to predict combustion chemistry features, we have begun to develop detailed mechanisms for the oxidation of higher hydrocarbons in a wide range of temperatures. However, very large mechanisms cannot be introduced into complex multi-dimensional fluid dynamics codes for the modelling of the combustion of practical fuels. For this reason, we have also used reduction methods for the simplification of large mechanisms in order to keep the essential features of the chemistry in realistic combustor configurations. Previous studies in jet-stirred and in premixed flames have shown similar combustion behaviours between kerosene and n-decane, concerning the nature of the products and the reactivity. For this reason, a detailed reaction mechanism for the oxidation of n-decane has been used to describe the combustion of kerosene in a jet-stirred reactor up to 40 atm, and a good prediction of the experimental concentration profiles of the major species has been obtained. This mechanism has been recently updated, and a general improvement of the predictions was obtained, especially for unburned hydrocarbons. In addition, a reduced mechanism was developed. However, in the conditions of our experiments, several aromatics have been found in significant amounts among the products of kerosene oxidation, where the oxidation of n-decane yields much less aromatics. This is due to the presence of mono-aromatics in kerosene, these compounds being the main source of benzene, toluene and xylene formed in kerosene combustion. Naphtenes are another class of compounds constituting kerosene. To take into account the presence of these different families in kerosene, we have added to the mechanism of n-decane oxidation, the detailed mechanisms of the oxidation of toluene and cyclohexane.

Author

Reaction Kinetics; Combustion Chambers; Computer Programs; Combustion Chemistry; Exhaust Emission; Exhaust Gases; Hydrocarbons; Oxidation

20000020842 Instituto Superior Tecnico, Mechanical Engineering Dept., Lisbon, Portugal

MODELLING OF A LEAN PREMIXED COMBUSTOR

Coelho, P. J., Instituto Superior Tecnico, Portugal; Salvada, P., Portuguese Air Force Academy, Portugal; Gas Turbine Engine Combustion, Emissions and Alternative Fuels; June 1999, pp. 15-1 - 15-13; In English; See also 20000020829; Copyright Waived; Avail: CASI; A03, Hardcopy; A06, Microfiche

A mathematical model of a fuel lean premixed axisymmetric combustor is presented and applied to an experimental facility. The combustor is constituted by a pre-chamber where propane is injected and mixed with the oxidant, and the combustion chamber where most of the reactions take place. The mathematical model is based on the numerical solution of the equations governing conservation of mass, momentum and energy, and transport equations for scalar quantities. The k-epsilon model, the eddy break-up or the eddy dissipation models, and the discrete ordinates model are used to simulate turbulence, combustion and radiation, respectively. The results are compared with experimental data. The grid size and the discretization scheme are shown to have a significant influence on the results, demonstrating the need for error estimation in practical engineering computations. The influence of the constants of the combustion model and the role of the radiation model are examined. The influence of the equivalence ratio and the inlet air temperature are also investigated.

Author

Mathematical Models; Combustion Chambers; Combustion Physics; Continuity Equation; Energy Transfer; Premixing; Engine Parts; Engine Design

20000020844 Office National d'Etudes et de Recherches Aerospatiales, Dept. Mesures Physiques, Palaiseau, France

OPTICAL DIAGNOSTICS APPLIED TO A JET DIFFUSION FLAME

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An experimental study was conducted on low speed hydrogen-air buoyant diffusion flames to investigate the vortex-flame interaction and the effect of the Lewis number on the flame structure. Simultaneous single shot measurements of temperature, pollutant nitric oxide (NO) and atomic oxygen (O) have been obtained using a combination of Coherent anti-Stokes Raman spectroscopy, laser-induced fluorescence and degenerate four-wave mixing. Temperature and molar fraction of NO and O are presented in two-dimensional maps and O are compared with theoretical predictions. It was found that temperature and NO concentration increase - with later being more significantly - in the compressed region of the flame whereas high concentration of oxygen atoms is located in the stretched region of the flame. Good agreement was found between the simulated and measured data.

Author

Diffusion Flames; Jet Flow; Hydrogen; Vortices; Flame Propagation; Lewis Numbers; Chemical Reactions; Optical Measurement

20000020845 Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Cologne, Germany

EXPERIMENTAL INVESTIGATION OF AN AXIALLY STAGED COMBUSTOR SECTOR WITH OPTICAL DIAGNOSTICS AT REALISTIC OPERATING CONDITIONS

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Contract(s)/Grant(s): BMBF-20T9403A; Copyright Waived; Avail: CASI; A03, Hardcopy; A06, Microfiche

A rectangular sector of an axially staged combustor built by

BMW-RR was investigated with optical diagnostics in a newly built experimental facility at DLR Cologne. The goal of the investigation was to acquire data on the combusting flow field of a practical combustor at realistic operating conditions to aid the design and validate results achieved with computational fluid dynamics (CFD). The rig is capable of operating at pressures up to 20 bar, preheat temperatures of 850K and air mass flows of 10 kg/s The combustor is optically accessible through the side windows and the combustor liners, which allows the use of planar imaging techniques. The measurement techniques applied so far are Doppler Global Velocimetry (DGV) for the isothermal flow, Laser Doppler Anemometry (LDA) for the gas velocity of the combusting flow, Phase Doppler Anemometry (PDA) for size and velocity of fuel droplets and Mie scattering of Kerosene for the imaging of the liquid fuel concentration. The reaction zone was investigated with measurements of the spontaneous OH emission. The paper reports results and experiences from those measurements at 1 and 6 bar. Application of CARS and OH-LIF for the in situ measurement of temperature and the extension of the application to 20 bar are planned for the immediate future.
Author
Combustion Chambers; Combustible Flow; In Situ Measurement; Computational Fluid Dynamics; Optical Measurement; Liquid Fuels

20000020849 National Aerospace Lab., Instrumentation Dept., Amsterdam, Netherlands
IN-FLIGHT SPECTROSCOPIC AIRCRAFT EMISSION MEASUREMENTS
Jentink, H. W., National Aerospace Lab., Netherlands; vanVeen, J. J. F., Netherlands Organization for Applied Scientific Research TNO, Netherlands; Gas Turbine Engine Combustion, Emissions and Alternative Fuels; June 1999, pp. 22-1 - 22-4; In English; See also 20000020829; Copyright Waived; Avail: CASI; A01, Hardcopy; A06, Microfiche

Aircraft emit their exhaust gases for the larger part during cruise conditions. The knowledge about the emissions in these conditions is limited because adequate in situ measurement methods are not available. In this presentation the complications encountered measuring exhaust gases in flight are addressed. The potential of spectroscopic measurement methods for this application is discussed. Experimental data gathered on ground are used to support the argumentation.
Author
Exhaust Gases; In Situ Measurement; Onboard Equipment; Cruising Flight; Gas Spectroscopy

20000020850 Defence Evaluation Research Agency, Propulsion Dept., Farnborough, UK
THE DESIGN AND EVALUATION OF A PILOTED, LEAN BURN, PREMIXED, PREVAPORISED COMBUSTOR
Wedlock, M. I., Defence Evaluation Research Agency, UK; Tilston, J. R., Defence Evaluation Research Agency, UK; Seoud, R. E., Defence Evaluation Research Agency, UK; Gas Turbine Engine Combustion, Emissions and Alternative Fuels; June 1999, pp. 23-1 - 23-12; In English; See also 20000020829; Copyright Waived; Avail: CASI; A03, Hardcopy; A06, Microfiche

A piloted, lean burn, premixed, prevaporised combustor was designed to significantly reduce NOx levels. The combustor performance was evaluated over a range of conditions typical of a future large subsonic turbofan. The results showed NOx reductions in the range of 70-80%. The work was carried out as part of the CEC BRITE EURAM LOWNOX II programme.
Author
Combustion Chambers; Nitrogen Oxides; Exhaust Emission; Premixing; Turbofans; Combustion; Environment Effects

20000020851 California Univ., Combustion Lab., Irvine, CA USA
ADVANCE FUEL INJECTION STRATEGIES FOR HIGH PERFORMANCE GAS TURBINE ENGINES
Samuelsen, Scott, California Univ., USA; McDonell, Vince, California Univ., USA; Gas Turbine Engine Combustion, Emissions and Alternative Fuels; June 1999, pp. 24-1 - 24-14; In English; See also 20000020829; Original contains color illustrations; Copyright Waived; Avail: CASI; A03, Hardcopy; A06, Microfiche

Advanced gas turbine combustion systems will demand fuel injection strategies that are efficient in the rapid mixing of fuel and air, sophisticated in the ability to control the spatial distribution of the fuel, and both sufficiently flexible and intelligent to accommodate change over the duty cycle of the engine. The paper reports performance of a candidate injector and strategies, through mechanistic studies with advanced diagnostics, to optimize the system.
Author
Fuel Injection; Fuel Combustion; Gas Turbine Engines; Pollution Control; Injectors

20000020853 BMW Rolls-Royce AeroEngines G.m.b.H., Dahlewitz, Germany
NOX REDUCTION IN A FUEL STAGED COMBUSTOR BY OPTIMISATION OF THE MIXING PROCESS AND THE RESIDENCE TIME
Brehm, N., BMW Rolls-Royce AeroEngines G.m.b.H., Germany; Schilling, T., BMW Rolls-Royce AeroEngines G.m.b.H., Germany; Mack, A., BMW Rolls-Royce AeroEngines G.m.b.H., Germany; Kappler, G., BMW Rolls-Royce AeroEngines G.m.b.H., Germany; Gas Turbine Engine Combustion, Emissions and Alternative Fuels; June 1999, pp. 27-1 - 27-13; In English; See also 20000020829; Original contains color illustrations; Copyright Waived; Avail: CASI; A03, Hardcopy; A06, Microfiche

The paper deals with research work for NOx reduction carried out on an axially staged combustor. The combustor is operated with airblast atomizers and the combustion process is controlled by turbulent diffusion, like today's single annular combustors. Therefore the NOx formation is mainly defined by the time the combustion products spend at high temperatures. The objective of the work presented here was the reduction of NOx by the optimisation of the mixing process, combined with a reduction of the overall residence time. Three concepts were first investigated by computational fluid dynamics (CFD). The special emphasis was to distinguish differences in the mixing process, which indicate an improvement for NOx reduction. Based on this, the different configurations were tested in a high pressure sector rig under realistic engine conditions. A systematic NOx reduction was achieved by optimisation of the combustor geometry, leading to a more enforced, fast combustion process.
Author
Fuel Combustion; Combustion Chambers; Mixing; Pollution Control; Nitrogen Oxides

20000020855 Naples II Univ., Dept. of Aerospace Engineering, Naples, Italy
IGNITION DIAGRAMS AND BIFURCATION MAPS
DiMaio, F. P., Naples II Univ., Italy; Barnieri, G., Consiglio Nazionale delle Ricerche, Italy; Lignola, P. G., Naples II Univ., Italy; Gas Turbine Engine Combustion, Emissions and Alternative Fuels; June 1999, pp. 31-1 - 31-9; In English; See also 20000020829; Copyright Waived; Avail: CASI; A02, Hardcopy; A06, Microfiche

In this work a method is presented for the analysis of models of combustion processes. The method, based on the theory of bifurcation and on that of continuation, permits the calculation of ignition diagrams for combustion systems reacting in zero dimensional combustion devices. The method is applied to combustion of hydrogen and the results are encouraging. Selected residence times have been investigated. A rich variety of dynamic behaviours has been detected, as experimentally observed.
Author
Combustion; Branching (Mathematics); Combustion Physics; Ignition; Mathematical Models

20000020857 Rolls-Royce Allison, Indianapolis, IN USA
FUEL/AIR PREPARATION IN THE DESIGN OF LOW EMISSIONS GAS TURBINE COMBUSTION SYSTEMS
Razdan, Mohan K., Rolls-Royce Allison, USA; Gas Turbine Engine Combustion, Emissions and Alternative Fuels; June 1999, pp. 34-1 - 34-11; In English; See also 20000020829; Copyright Waived; Avail: CASI; A03, Hardcopy; A06, Microfiche

This paper discusses issues related to practical fuel injection methods, and the key factors affecting the fuel/air mixing process in low emission gas turbine combustors. The mixing of fuel and air has to be accomplished in the shortest possible residence time both for current retroflt applications as well as for future high performance engines that operate at substantially higher inlet temperatures and pressures, where flashback and autoignition are serious concerns.

The choice of a fuel injection method is strongly influenced not only by the selected geometry and size of a fuel/air preparation module but also by its interaction with the module air flow. Combining pressure swirl and prefilming airblast atomization concepts in a single hybrid design presents an attractive approach for achieving satisfactory atomization over a wide operating range of the combustor. Internally mixed atomization concepts show beneficial effects on fuel atomization. A fuel concentration profile tailored to the local velocity profile at the mixing module exit minimizes the flashback propensity. Autoignition concerns will limit the application of fully prevaporized lean premixed low emission approach to operating pressures up to 40 to 50 atmospheres.
Author
Air Flow; Spontaneous Combustion; Ignition; Flashback; Engine Design; Fuel Injection; Combustion Chambers; Gas Turbine Engines

20000020858 Imperial Coll. of Science Technology and Medicine, Thermofluids Section, London, UK
EXPERIMENTS IN A SMALL GAS-TURBINE COMBUSTOR WITH GAS AND LIQUID FUELS
Heyes, A. L., Imperial Coll. of Science Technology and Medicine, UK; Jelercic, D., Imperial Coll. of Science Technology and Medicine, UK; Whitelaw, J. H., Imperial Coll. of Science Technology and Medicine, UK; Gas Turbine Engine Combustion, Emissions and Alternative Fuels; June 1999, pp. 35-1 - 35-17; In English; See also 20000020829; Original contains color illustrations
Contract(s)/Grant(s): EPSRC-GR/K-60985; Copyright Waived; Avail: CASI; A03, Hardcopy; A06, Microfiche

Measurements of velocity, temperature, emissions and droplet diameters are reported for combustion of kerosene in a sector of a gas-turbine combustor at atmospheric pressure and air-fuel ratios and preheat temperatures corresponding to cruise and take-off conditions. The results allow comparison of flows with fuelling devices which include gas jets, a T-vaporiser and two arrangements of fan sprays, and show the extent to which droplet diameters and velocities were affected by the rate of fuel flow and by the air preheat in the main vortex of the primary zone. A single fan spray led to a central core of combustion with cold flow on either side so that the pattern factor had no practical value and subsequent experiments made use of two sprays. The droplet numbers density fell rapidly with distance from the injectors and with increasing air-fuel ratio and preheat temperature, and the arithmetic and Sauter mean diameters tended to decrease as droplets evaporated and burned. The exit-plane profiles of temperature were more uniform with the higher preheat temperature and lower air-fuel ratio which resulted in a combustion efficiency of 98.3% The lower preheat temperature led to a three-fold increase in concentrations of unburned hydrocarbon and efficiency of 91.6%. Emissions were similar with the fan spray and the vaporiser arrangements, with NOx concentrations larger by 10% in the rich flows and smaller by 25% with the higher air-fuel ratio and lower preheat temperature.
Author
Combustion Chambers; Gas Turbine Engines; Engine Design; Propulsion System Performance; Fuel Combustion; Fuel Flow

20000020859 Pennsylvania State Univ., Dept. of Mechanical Engineering, University Park, PA USA
AGARD WORKSHOPS ON ACTIVE COMBUSTION CONTROL FOR PROPULSION SYSTEMS
Yang, Vigor, Pennsylvania State Univ., USA; Schadow, Klaus C., Naval Air Warfare Center, USA; Gas Turbine Engine Combustion, Emissions and Alternative Fuels; June 1999, pp. 36-1 - 36-21; In English; See also 20000020829; Copyright Waived; Avail: CASI; A03, Hardcopy; A06, Microfiche

This report summarizes the findings and conclusions of two A(iARD workshops on 'Active Combustion Control for Propulsion Systems' that were held during May 6-9. 1996, in Athens. Greece and during Oct. 16-18, 1997 in Brussels, Belgium respectively. The workshops. Organized in response to increased interest in application of' active control in combustion systems, were attended by representatives from industry, government and universities in Europe and the USA. The objectives of the workshops were to: (1) define the requirements of future combustors and combustion processes, (2) determine the status of active combustion control (ACC) systems, (3) assess the potential of ACC to meet goals of the future combustors performance, and (4) determine near- and longterm ACC research and development needs. A special concern of the workshops was the confirmation of international collaborations between organizations working in this field.
Author
Active Control; Combustion Chambers; Combustion Control; Engine Design

20000020860 Georgia Inst. of Tech., School of Aerospace Engineering, Atlanta, GA USA
COMBUSTION INSTABILITIES IN LOW NOX GAS TURBINES AND THEIR ACTIVE CONTROL
Zinn, Ben T., Georgia Inst. of Tech., USA; Lieuwen, Tim, Georgia Inst. of Tech., USA; Neumeier, Yedidia, Georgia Inst. of Tech., USA; Gas Turbine Engine Combustion, Emissions and Alternative Fuels; June 1999, pp. 37-1 - 37-12; In English; See also 20000020829; Sponsored in part by AGTSR; Copyright Waived; Avail: CASI; A03, Hardcopy; A06, Microfiche

This paper presents an investigation of the mechanisms and control of combustion instabilities in low NOx gas turbines (LNGT) that burn fuel in a lean, premixed (LP) mode of combustion. Physical considerations show that these instabilities may be caused by interactions of combustor pressure oscillations with the reactants supply rates, producing equivalence ratio (0) perturbations in the inlet duct. These perturbations are convected by the mean flow to the combustor where they produce large amplitude heat release oscillations that drive combustor pressure oscillations. The regions of instability can be approximately described in terms of a ratio of the reactants' convective time from the fuel injector to the combustor and the period of the oscillations (with some modifications that account for the structure of the combustion region). Significantly, these predictions are in good agreement with available experimental data, strongly suggesting that the proposed mechanism properly accounts for the essential physics of the problem. The predictions of this study indicate that passive control strategies may not, in general, provide a viable means for controlling these instabilities, due to the multiple number of modes that may be excited by the combustion process. The paper closes with a discussion of a recently developed, observer based, active control system and its control of combustion instabilities in a small scale Georgia Tech combustor and a sub scale Westinghouse gas turbine are presented. These results demonstrate that active control is a promising means for controlling combustion instabilities.
Author
Active Control; Combustion; Combustion Stability; Combustion Chambers; Nitrogen Oxides; Reaction Kinetics; Premixing; Gas Turbines

20000020861 United Technologies Research Center, East Hartford, CT USA
ACTIVE CONTROL OF COMBUSTION INSTABILITY IN A LIQUID-FUELED, LOW-NOX COMBUSTOR
Cohen, Jeffrey M., United Technologies Research Center, USA; Rey, Nancy M., United Technologies Research Center, USA; Jacobson, Clas A., United Technologies Research Center, USA; Anderson, Torger J., United Technologies Research Center, USA; Rosfjord, Thomas J., United Technologies Research Center, USA; Gas Turbine Engine Combustion, Emissions and Alternative Fuels; June 1999, pp. 38-1 - 38-10; In English; See also 20000020829; Copyright Waived; Avail: CASI; A02, Hardcopy; A06, Microfiche

A practical active control system for the mitigation of combustion instability has been designed and demonstrated in a lean, premixed, single-nozzle combustor at realistic engine operating conditions. A full-scale engine fuel nozzle was modified to incorporate a simple fuel flow actuator. Results indicate that the system was capable of reducing pressure fluctuations by 82% (15 dB or 5.6X) while maintaining or reducing NOx and CO emissions levels.
Author
Active Control; Combustion Stability; Combustion Chambers; Premixing; Fuel Flow; Environment Effects; Fuel Injection

20000020863 Siemens A.G., Muelheim-Ruhr, Germany
APPLICATION OF ACTIVE COMBUSTION CONTROL TO SIEMENS HEAVY DUTY GAS TURBINES
Hoffmann, S., Siemens A.G., Germany; Weber, G., Siemens A.G., Germany; Judith, H., Siemens A.G., Germany; Hermann, J., Ingenieurbuero fuer Thermoakustik G.m.b.H., Germany; Orthmann, A.,

Ingenieurbuero fuer Thermoakustik G.m.b.H., Germany; Gas Turbine Engine Combustion, Emissions and Alternative Fuels; June 1999, pp. 40-1 - 40-13; In English; See also 20000020829; Copyright Waived; Avail: CASI; A03, Hardcopy; A06, Microfiche

Modern gas turbines are usually featuring lean premixed combustion in order to keep the emissions at an acceptable level. Ever increasing reaction densities, however, result in an increased tendency to exhibit dynamic flame instabilities. Active Instability Control (AIC) is a very powerful and flexible tool for the suppression of these instabilities. Due to the high fuel mass flow and high system pressures, the application of AIC to heavy duty gas turbines, however, is a difficult task. This paper reports on several applications of an AIC system to the Siemens Model V84.3A and V94.3A heavy duty gas turbines featuring annular combustion chambers. Depending on the burner configuration used, the AIC successfully solved four different tasks: Damping of combustion oscillations by up to 17 dB (86%); Complete suppression of combustion oscillations at intermediate load levels and during switch over processes; Suppression of combustion oscillations at low pilot gas mass flow during lean premixed operation, allowing for a substantial reduction of the NOx emissions; and Suppression of combustion oscillations at base load level, allowing for a 5%-point load increase. Several tests showed the long-term reliability of the hardware components and the failure tolerance of the AIC system.

Author

Active Control; Combustion Chambers; Combustion Stability; Gas Turbines; Combustion; Premixing; Emission

20000020864 Pennsylvania State Univ., University Park, PA USA
OPTIMIZATION OF ACTIVE CONTROL SYSTEMS FOR SUPPRESSING COMBUSTION INSTABILITY

Lee, Jong Guen, Pennsylvania State Univ., USA; Hong, Boe-Shong, Pennsylvania State Univ., USA; Kim, Kwanwoo, Pennsylvania State Univ., USA; Yang, Vigor, Pennsylvania State Univ., USA; Santavicca, Domenic, Pennsylvania State Univ., USA; Gas Turbine Engine Combustion, Emissions and Alternative Fuels; June 1999, pp. 41-1 - 41-12; In English; See also 20000020829

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Combustion instabilities have proven to be a major factor limiting the development of high performance, low emissions gas turbine engines. This is a result of the fact that our current understanding of the underlying phenomenology of unstable combustion is incomplete, making it difficult to design high performance, low emissions combustors which are stable over their entire operating range. This problem is further aggravated by the fact that achieving stable combustion in a single-nozzle test of the actual combustor hardware is not a guarantee that the full-scale engine will not exhibit instabilities. Active combustion control provides an alternate approach to the successful development of high performance, low emissions gas turbine combustion systems. In theory, an active control system can be designed without a priori understanding of the nature or phenomenology of the instability. In practice, however, the optimization of a successful active control system requires a fundamental understanding of the phenomenology of unstable combustion. particularly in the specific engine of interest and over the complete range of desired engine operating conditions. This paper presents results from a research program aimed at the development and optimization of an active control system for use in a low emissions gas turbine combustor. An overview of the control methodology is presented first. Then the theoretical model, which forms the basis of the model-based controller, is presented and preliminary results discussed. And lastly, experimental measurements of the stability characteristics of the lean premixed, dump combustor used in this study and of the response of the secondary fuel injector and the combustor to various control parameters are presented and the use of this type of information to optimize the control system is discussed.

Author

Active Control; Combustion; Combustion Stability; Combustion Chambers; Gas Turbine Engines; Premixing

20000020866 Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Inst. for Propulsion Technology, Cologne, Germany
OPTICAL MEASUREMENTS OF SPRAY COMBUSTION IN A SINGLE SECTOR COMBUSTOR FROM A PRACTICAL FUEL INJECTOR AT HIGHER PRESSURES

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A research combustor for the investigation of spray combustion of practical aeroengine fuel injectors has been built. It approximates a single sector of an annular combustor. It allows optical access for laser based measuring techniques with point and planar measuring volumes and can be operated up to 20 bar with preheat temperatures of up to 850 K. For this contribution, the combustor has been operated at 3, 6 and 9 bar and at preheat temperatures of 473 K and 673 K with a technology injector supplied by BMW-RR. The isothermal flowfield was investigated by Laser Doppler Anemometry and the combusting flow by Phase Doppler Anemometry, Laser Induced Fluorescence of Kerosene and OH and imaging of the spontaneous OH emission. The injector showed a large central recirculation with an almost radial expansion of the gas flow without outer recirculation. At 6 bar, 473 K preheat and AFR 20, the bulk of the spray is evaporated before the reaction rate as signalled by OH* emission intensity reaches high values, which confirms earlier estimates postulating external group combustion for aeroengines. The investigated atomizer shows a marked influence of temperature and almost no influence of pressure on the measured drop sizes which was attributed to the design of the internal airflow promoting prompt atomization as the dominant atomization mode.

Author

Optical Measurement; Pressure Effects; Combustion; Combustion Chambers; Combustible Flow; Fuel Injection; Air Flow; Aircraft Engines; Injectors

20000020867 Innovative Scientific Solutions, Inc., Beavercreek, OH USA
COMBUSTION CHARACTERISTICS OF A TRAPPED VORTEX COMBUSTOR

Sturgess, G. J., Innovative Scientific Solutions, Inc., USA; Hsu, K.-Y., Innovative Scientific Solutions, Inc., USA; Gas Turbine Engine Combustion, Emissions and Alternative Fuels; June 1999, pp. 44-1 - 44-13; In English; See also 20000020829

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The lean blowout stability of a laboratory-scale version of a trapped-vortex combustor is described. Three cavity axial lengths were tested at atmospheric pressure and ambient temperature over a range of mainstream velocities from 15 to 95 m/s. For each geometry and mainstream velocity, three values of cavity jet airflow were used; 5, 10 and 15 percent of the mainstream mass flow rate respectively. Pressure transducer and microphone measurements were used to assess noise levels and acoustic coupling of heat release with cavity dynamics. Planar laser-induced fluorescence of OH was used to obtain qualitative understanding of the flame structures. It was found that at very low cavity air-jet momentum, the flow in the cavity is poorly organized and is highly subject to mainstream influences. A range of operating conditions exists where the flame at blowout is contained within the cavity, and blowout stability is high. At higher cavity mass loadings burning in the cavity is not contained and is supplemented by burning in the interfacial shear layer between mainstream and cavity flows. Blowout then is from this shear layer, and depends on the ratio of mainstream to cavity momentum and the cavity axial length, as well as cavity loading Comparison of lean blowouts with those for a swirl-stabilized combustor indicates that a well-designed trapped vortex combustor can have superior operability characteristics.

Author

Trapped Vortices; Combustion; Combustion Chambers; Jet Flow; Combustion Stability; Engine Design; Propulsion System Configurations; Air Jets

20000020869 GASTEC N.V., Apeldoorn, Netherlands
CATALYTIC COMBUSTION CONCEPTS FOR INDUSTRIAL GAS TURBINES

derKinderen, J. M., GASTEC N.V., Netherlands; vanYperen, R., GASTEC N.V., Netherlands; Gas Turbine Engine Combustion, Emissions and Alternative Fuels; June 1999, pp. 47-1 - 47-13; In English; See also 20000020829; Copyright Waived; Avail: CASI; A03, Hardcopy; A06, Microfiche

The desire to reduce pollutants, e.g. oxides of nitrogen (NOx), carbon monoxide and unburned hydrocarbons, from gas turbine exhausts has stimulated the research into the use of catalytic combustion systems. These systems have the potential to minimise emissions of the above pollutants and have the added advantage of greatly reducing combustion induced vibrations, to which conventional low emission combustion systems are prone. The development of a catalytic combustion system for gas turbines was one of the goals in the Brite EuRam project BRE2-CT92-0309 (Catalytic Combustion Systems for Pollutant Suppression in Industrial Gas Turbines, Reformers and Radiant Heaters). Durable high temperature catalytic combustion systems, which were optimised for the combustion of natural gas in the temperature range of 700 to 1500 K, and suitable for incorporation into ultra low emissions combustion systems for high pressure ratio, high efficiency industrial gas turbines were researched. In order to meet typical combustion requirements, a multi-stage catalytic combustion system incorporating a preburner, one or more catalysts and a homogeneous reaction zone was envisaged. A catalytic high pressure test rig was built, which was capable of testing at a maximum of 20 - 25 bar and an outlet temperature of 1600 K. Tests showed that it was possible to reach a 100% conversion of methane with hardly any CO and NOx in the outlet stream. However, further research is required to investigate new or improved high temperature catalyst systems with high activity and excellent thermal stability and integrity.
Author

Catalysts; Combustion; Combustion Products; Contaminants; Gas Turbines

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SOOT FORMATION MODELLING IN TURBULENT DIFFUSION FLAMES

DiMartino, P., Alfa Romeo S.p.A., Italy; Cinque, G., Alfa Romeo S.p.A., Italy; Gas Turbine Engine Combustion, Emissions and Alternative Fuels; June 1999, pp. 50-1 - 50-13; In English; See also 20000020829; Copyright Waived; Avail: CASI; A03, Hardcopy; A06, Microfiche

The formation of soot and its emission from practical combustion devices is of interest to engineers and designers of gas turbines, diesel engines and power plants. Although advances have been made, soot formation models must skill be regarded as being far from complete because qualitative understanding of the physical processes remains uncertain. The purpose of this paper was twofold: the first step was to choose the best soot formation models in the calculation of kerosine turbulent diffusion flame, more appropriate to gas turbine combustors for aircraft engines. The next step has been the optimization on of the kinetic constants of soot models by comparing the computed results with available experimental measurements. Finally these constants have been used to couple soot and radiation in order to study the impact on local chemistry, temperature and heat transfer to the combustor walls. Comparisons with experiments concerning wall temperatures have also been performed.
Author

Diffusion Flames; Combustion Chambers; Soot; Mathematical Models; Combustion

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EFFICIENT NUMERICAL CALCULATION OF EVAPORATING SPRAYS IN COMBUSTION CHAMBER FLOWS

Schmehl, R., Karlsruhe Univ., Germany; Klose, G., Karlsruhe Univ., Germany; Maier, G., Karlsruhe Univ., Germany; Wittig, S., Karlsruhe Univ., Germany; Gas Turbine Engine Combustion, Emissions and Alternative Fuels; June 1999, pp. 51-1 - 51-14; In English; See also 20000020829; Original contains color illustrations; Copyright Waived; Avail: CASI; A03, Hardcopy; A06, Microfiche

Representing two different conceptual approaches, either Eulerian continuum models or Lagrangian particle models are commonly applied for the numerical description of dispersed two phase flows. Taking advantage of the positive features inherent to each model, a combination approach is presented in this study for the efficient computation of liquid fuel sprays in combustor flows. In the preconditioning stage, Eulerian transport equations for gas phase and droplet phase are solved simultaneously in a block-iterative scheme based on a coarse discretization of spray boundary conditions at the nozzle. Due to the close coupling of both phases, the time expense of this approximate flow field computation is not much higher as for single phase flows. In the refinement stage, Lagrangian droplet tracking is applied with a detailed discretization of initial conditions. To account for complete interaction between gas phase and droplets, gas flow solution and droplet tracking are concatenated by an iterative procedure. In this stage, the numerical description of the spray is enhanced by additional modeling of droplet breakup. Results of numerical simulations are compared with measurements of the two phase flow in a premix duct of a LPP research combustor.
Author

Two Phase Flow; Combustion Chambers; Evaporation; Fuel Sprays; Continuum Modeling

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POLLUTANTS EMISSION PREDICTION IN COMBUSTION IN INERT POROUS MEDIA

Malico, I., Instituto Superior Tecnico, Portugal; Zhou, X. Y., Instituto Superior Tecnico, Portugal; Pereira, J. C. F., Instituto Superior Tecnico, Portugal; Gas Turbine Engine Combustion, Emissions and Alternative Fuels; June 1999, pp. 53-1 - 53-8; In English; See also 20000020829
Contract(s)/Grant(s): PRAXIS-XI/BD/5885/95; PRAXIS-XXI/BPD/11846/97; Copyright Waived; Avail: CASI; A02, Hardcopy; A06, Microfiche

Two-dimensional predictions of flow, temperature, major species mass fractions and emissions were obtained for a porous burner. Combustion was described by the skeletal mechanism of Glarborg et al. (1992), which consists of 77 reactions and 26 species. Thermal non-equilibrium between the gas and solid phases was considered and two energy equations were solved. The discrete ordinates method was used to calculate radiation in an emitting, absorbing and isotropically scattering medium. For the two-dimensional calculations, predicted CO and NO emissions are compared with experimental values for a 7 KW thermal power and several excess air ratios. The model underpredicts the CO emissions and overpredicts the NO emissions, especially for close to stoichiometric conditions. The influence of pressure on combustion in porous media was examined using a one dimensional model for a very simple burner configuration. It may be concluded that, as the pressure is increased, the flame speed is reduced, CO emissions are decreased and NO emissions are increased.
Author

Contaminants; Two Dimensional Flow; Combustion; Gas-Solid Interactions; Porosity; Burners; Emission; Pressure Effects

20000020875 Office National d'Etudes et de Recherches Aerospatiales, Paris, France

CHARACTERIZATION OF AUTOIGNITION AND FLASHBACK IN PREMIXED INJECTION SYSTEMS *[CARACTERISATION DES SYSTEMES D'INJECTION PREMELANGES EN AUTO-INFLAMMATION ET REMONTEE DE FLAMME]*

Guin, C., Office National d'Etudes et de Recherches Aerospatiales, France; Gas Turbine Engine Combustion, Emissions and Alternative Fuels; June 1999, pp. 30-1 - 30-20; In English; In French; See also 20000020829; Original contains color illustrations; Copyright Waived; Avail: CASI; A03, Hardcopy; A06, Microfiche

Lean premixed combustors performed very well for reducing NOx emissions, but the concept is penalised by problems of autoignition and flashback, especially in motors with a high pressure ratio. In the framework of the Brite Euram programme, ONERA has therefore developed a special test facility for characterising these phenomena in premixed systems under operational conditions and independently of the combustor. The test rig allows continuous monitoring of the flow within the mixing duct by an optical system able to detect autoignition and flashback. Several concepts developed for the manufacturers Turbomeca, Volvo, BMW, Rolls-Royce and Snecma were tested in the facility. The safe operating limits for each concept were determined. This paper describes the test facility, the procedure used and the measurements made. The main parameters governing the phenomena are described and a law defining the

autoignition conditions is established. A few examples of measurement records are used to explain how the results are interpreted.
Author
Combustion Chambers; Continuum Flow; Test Facilities; Ignition; Premixing; Injection; Spontaneous Combustion; Flashback; Engine Design

20010067720 Rolls-Royce Ltd., Coventry, West Midlands, UK
ACTIVE CONTROL OF COMBUSTION AND ITS APPLICATIONS
Moran, A. J., Rolls-Royce Ltd., Coventry, UK; Steele, D., Rolls-Royce Ltd., UK; Dowling, A. P., Cambridge Univ., UK; Active Control Technology for Enhanced Performance Operational Capabilities of Military Aircraft, Land Vehicles and Sea Vehicles; June 2001, pp. 2-1 - 2-8; In English; See also 20010067671; Original contains color illustrations; Copyright Waived; Avail: CASI; A02, Hardcopy

The ducted flame in any of its forms can have the tendency to interact with its surroundings. When this interaction takes the form of thermo-acoustic instabilities the consequences can be grave. These instabilities have been recognized as a problem for many decades and have appeared in many forms of engine including rocket motors, ramjets, main engine gas turbine combustors, and after burning systems. It is true to say that the phenomena has not been truly understood and that many researchers have come up with several theories as to how these thermo-acoustic instabilities occur. In the field of engineering, the ability to fix the problem rather than fully understand the problem has been a principle that has been applied for many years. The approaches taken to fixing thermoacoustic problems have been either radical re-design of the combustion system or the application of passive damping techniques. In the past decade, however, a further technique has been given to the combustion designer, that technique being the ability to use active control. This paper outlines how the technique has been developed, from small scale pilot rig testing through to full engine demonstration, and how active control may be applied to land-based gas turbines in the future. With the introduction of ultra low emission lean pre-mixed combustion systems to land based gas turbines the propensity to exhibit thermo-acoustic instabilities has increased. Actively controlling the instability is a real option, the benefits of gaining extensive experience with the technology on land will help to promote the technology for future application to aircraft.
Author
Acoustic Instability; Active Control; Combustion; Thermoacoustic Effects

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COMBINATION OF ACTIVE INSTABILITY CONTROL AND PASSIVE MEASURES TO PREVENT COMBUSTION INSTABILITIES IN A 260MW HEAVY DUTY GAS TURBINE
Hermann, J., Ingenieurbuero fuer Thermoakustik G.m.b.H., Germany; Orthmann, A., Ingenieurbuero fuer Thermoakustik G.m.b.H., Germany; Hoffmann, S., Siemens A.G., Germany; Berenbrink, P., Siemens A.G., Germany; Active Control Technology for Enhanced Performance Operational Capabilities of Military Aircraft, Land Vehicles and Sea Vehicles; June 2001, pp. 3-1 - 3-9; In English; See also 20010067671; Original contains color illustrations; Copyright Waived; Avail: CASI; A02, Hardcopy

Reducing the output of NOx pollutants and enhancing efficiency are the two major aims pursued by developers of modern gas turbines. In order to achieve them, lean premix combustion is preferred, turbine inlet temperatures and thus power densities within the combustion chamber system are being continuously increased to augment efficiency. Due to this fact, the tendency of modern combustion systems to develop so-called self-excited combustion oscillations keeps increasing. After briefly discussing the oscillation problems encountered with the annular combustion chamber of a Siemens type V943A stationary gas turbine, particular attention will be paid to suppressing these oscillations by passive and active means. The passive measures presented, i.e., extending the burner nozzle, were intended to detune the combustion system by prolonging the time lag required by the combustible mixture exiting the burner outlet to reach the combustion zone. Moreover, to suppress periodic vortex shedding, another possible cause for combustion instabilities, those extensions were inclined in a certain angle with respect to the main flow direction. To prevent the in-phase lock of all 24 burners promoting the excitation of any azimuthal mode, the burners were selected to have different time lags, and were arranged asymmetrically within the annular combustion chamber. In addition to these passive measures, a multi-channel Active Instability Control (AIC) system was implemented to achieve further damping. With the AIC system presented, any burner oscillations occurring are measured by pressure sensors; their signals are processed by means of a multi-channel controller, and then transmitted to actuators designed to damp down combustion oscillations. The points of intervention selected to do so were the gas supplies of the pilot flames. In order to achieve optimum response, every single one of the 24 burners was fitted with its own field demonstrations for various type V943A gas turbines, the presented measures were successfully studied and active suppression of combustion oscillations proved to be highly flexible in dealing with various oscillation problems.
Author
Active Control; Burners; Oscillations; Combustion Stability

20010067722 Naval Air Systems Command, Propulsion and Power Engineering, Patuxent River, MD USA
ACTIVE COMBUSTION CONTROL FOR MILITARY GAS TURBINE ENGINES
Richman, Marcus H., Naval Air Systems Command, USA; Richman, Michael S., Naval Air Systems Command, USA; Active Control Technology for Enhanced Performance Operational Capabilities of Military Aircraft, Land Vehicles and Sea Vehicles; June 2001, pp. 4-1 - 4-7; In English; See also 20010067671; Copyright Waived; Avail: CASI; A02, Hardcopy

The US Navy, as a participant in the USA' Integrated High Performance Turbine Engine Technology (IHPTET) initiative, is dedicated to increasing aircraft engine performance to satisfy the propulsion requirements of future Navy aircraft. This is accomplished by identifying the propulsion requirements, in terms of performance and total cost, for specific Navy aircraft. The required engine technology advances are then broken down into specific engine component technology objectives. Advanced technology is then developed on the component level. Once an appropriate level of readiness is reached, the components are then assembled into an engine for overall advanced propulsion system demonstration. Technologies from this demonstrator engine are then made available to development engine programs, such as the Joint Strike Fighter (JSF), for further development and eventual transition to production engine programs. The figure of merit used to measure the performance is engine thrust/weight ratio. The role of the combustor in this endeavor is to provide the necessary temperature rise to increase core engine output. This drives the combustor to operate at higher fuel/air ratios which in turn drives a larger portion of the combustion volume to operate at or near stoichiometric conditions. Combustor operation at these levels must be achieved with an eye to numerous other parameters such as durability, weight, cost, and emissions. Active Combustion Control is one of the key technologies required to meet these objectives simultaneously.
Author
Active Control; Propulsion; Combustion Chambers; Control Systems Design

20010067723 NASA Glenn Research Center, Cleveland, OH USA
LONGITUDINAL MODE AEROENGINE COMBUSTION INSTABILITY: MODEL AND EXPERIMENT
Cohen, J. M., United Technologies Research Center, USA; Hibshman, J. R., United Technologies Research Center, USA; Proscia, W., United Technologies Research Center, USA; Rosfjord, T. J., United Technologies Research Center, USA; Wake, B. E., United Technologies Research Center, USA; McVey, J. B., jbScienceS, USA; Lovett, J., Pratt and Whitney Aircraft, USA; Ondas, M., Pratt and Whitney Aircraft, USA; DeLaat, J., NASA Glenn Research Center, USA; Breisacher, K., NASA Glenn Research Center, USA; Active Control Technology for Enhanced Performance Operational Capabilities of Military Aircraft, Land Vehicles and Sea Vehicles; June 2001, pp. 5-1 - 5-9; In English; See also 20010067671; Copyright Waived; Avail: CASI; A02, Hardcopy

Combustion instabilities in gas turbine engines are most frequently encountered during the late phases of engine development, at which point they are difficult and expensive to fix. The ability to replicate an engine-traceable combustion instability in a laboratory-scale experiment offers the opportunity to economically diagnose the problem more completely (to determine the root cause), and to investigate solutions to the problem, such as active control. The development and validation of active combustion instability control

requires that the casual dynamic processes be reproduced in experimental test facilities which can be used as a test bed for control system evaluation. This paper discusses the process through which a laboratory-scale experiment and be designed to replicate an instability observed in a developmental engine. The scaling process used physically-based analyses to preserve the relevant geometric, acoustic, and thermo-fluid features, ensuring that results achieved in the single-nozzle experiment will be scalable to the engine.
Author
Active Control; Combustion Stability; Experimentation

20010067737 Virginia Polytechnic Inst. and State Univ., Reacting Flows Lab., Blacksburg, VA USA
AN EXPERIMENTAL EXAMINATION OF THE RELATIONSHIP BETWEEN CHEMILUMINESCENT LIGHT EMISSIONS AND HEAT-RELEASE RATE UNDER NON-ADIABATIC CONDITIONS
Haber, L. C., Virginia Polytechnic Inst. and State Univ., USA; Vandsburger, U., Virginia Polytechnic Inst. and State Univ., USA; Saunders, W. R., Virginia Polytechnic Inst. and State Univ., USA; Khanna, V. K., Virginia Polytechnic Inst. and State Univ., USA; Active Control Technology for Enhanced Performance Operational Capabilities of Military Aircraft, Land Vehicles and Sea Vehicles; June 2001, pp. 20-1 - 20-8; In English; See also 20010067671; Copyright Waived; Avail: CASI; A02, Hardcopy

Combustion instability research has matured over the last decade and with it the need for more detailed diagnostics has increased. One main gap in the diagnostics is the ability to obtain a reliable quantitative measure of unsteady heat-release rate. In an effort to move in this direction using chemiluminescence as the measured quantity, this paper examines the formation of chemiluminescent light in premixed flames under non-adiabatic conditions. The main chemiluminescent emitters considered in the study are OH* and CH*. Experimental results for two types of burners are reported, a laminar Bunsen burner with co-flow and a ceramic honeycomb flat flame burner. The study shows that although the chemiluminescence observed in the two burners behaves very differently with respect to changes in experimental variables, the variation can be fully understood. OH* chemiluminescence is found to be a good indicator of heat-release in both burners, whereas CH* chemiluminescence is shown to be insensitive to some changes in heat-release rate. Based on the experimental results, the notion that chemiluminescence yield behaves linearly with flow-rate cannot be universally supported. The non-linear variation observed is shown to correspond to an equally nonlinear variation of heat-release with flow-rate. The results of the study thus have important ramifications for the interpretation of chemiluminescence measurements in dynamic combustion environments.
Author
Burners; Chemiluminescence; Combustion Stability; Heat Transfer

20010067738 Office National d'Etudes et de Recherches Aerospatiales, Paris, France
CONTROL OF COMBUSTION INSTABILITIES ON A RIJKE TUBE BY A NEURAL NETWORK
Blonbou, R., Office National d'Etudes et de Recherches Aerospatiales, France; Laverdant, A., Office National d'Etudes et de Recherches Aerospatiales, France; Active Control Technology for Enhanced Performance Operational Capabilities of Military Aircraft, Land Vehicles and Sea Vehicles; June 2001, pp. 21-1 - 21-16; In English; See also 20010067671; Copyright Waived; Avail: CASI; A03, Hardcopy

Combustion instabilities still constitute a major problem for powerplant development. In this paper, a Rijke tube which presents, for some operating conditions, instabilities with pressure level up to 145 dB/Hz, is considered. In order to control instabilities, an Internal Model Control System for nonlinear plants, that uses two neural networks, has been developed. The first one is an Internal Model which approximates the plant forward dynamic (the learning process). The second one gives the adaptive control input. The capacity of approximating the noisy signals of instabilities (microphone or photomultiplier for OH emission proportional to heat release), with a good precision, is demonstrated. Attenuation of instabilities, for fixed or variable operating conditions, with pressure level attenuation up to 60 dB/Hz, has been obtained.
Author
Combustion Stability; Control Systems Design; Attenuation

20010067739 Cambridge Univ., Engineering Dept., Cambridge, UK
ADAPTIVE ALGORITHMS FOR CONTROL OF COMBUSTION
Evesque, S., Cambridge Univ., UK; Dowling, A. P., Cambridge Univ., UK; Annaswamy, A. M., Massachusetts Inst. of Tech., USA; Active Control Technology for Enhanced Performance Operational Capabilities of Military Aircraft, Land Vehicles and Sea Vehicles; June 2001, pp. 22-1 - 22-13; In English; See also 20010067671
Contract(s)/Grant(s): N00014-99-1-0448; Copyright Waived; Avail: CASI; A03, Hardcopy

Rather than investigate a particular combustor, a whole class of combustion systems, susceptible to damage from combustion instabilities, is considered. Under some simple and realistic assumptions (pressure waves reflected from the combustor boundaries smaller than incoming waves, flame stable in itself, limited bandwidth flame response), it is demonstrated that a finite dimensional approximation to the open-loop transfer function of such a combustion system satisfies some general properties (stable zeros, small relative degree) that are exploited to design adaptive active controllers guaranteed to stabilize the self-excited combustion oscillations. In particular, for the practical case of a combustion system with time delay, a completely new and simple adaptive control design is presented and a formal proof for stability is given. The performance of such stable adaptive controllers is illustrated in a simulation.
Author
Adaptive Control; Algorithms; Combustion Stability

20010067740 Massachusetts Inst. of Tech., Dept. of Mechanical Engineering, Cambridge, MA USA
MODELING AND CONTROL OF COMBUSTION INSTABILITY USING FUEL INJECTION
Hathout, J. P., Massachusetts Inst. of Tech., USA; Annaswamy, A. M., Massachusetts Inst. of Tech., USA; Ghoniem, A. F., Massachusetts Inst. of Tech., USA; Active Control Technology for Enhanced Performance Operational Capabilities of Military Aircraft, Land Vehicles and Sea Vehicles; June 2001, pp. 23-1 - 23-12; In English; See also 20010067671
Contract(s)/Grant(s): N00014-99-1-0448; NSF ECS-97-13415; Copyright Waived; Avail: CASI; A03, Hardcopy

Active control using periodic fuel injection has the potential of suppressing combustion instability without radically changing the engine design or sacrificing performance. In this paper, we carry out a study of optimal model-based control of combustion instability using fuel injection. The model developed is physically based and includes the acoustics, the heat-release dynamics, their coupling, and the injection dynamics. A heat-release model with fluctuations in the flame surface area as well as in the equivalence ratio is derived. We show that area fluctuations coupled with the velocity fluctuations drive longitudinal modes to resonance caused by phase-lag dynamics, while equivalence ratio fluctuations can destabilize both longitudinal and bulk modes caused by time-delay dynamics, similar to experimental observations. The dynamics of proportional and two-position (on-off) fuel injectors are included in the model. Using the overall model, two different control designs are proposed. The first is an LQG/LTR controller where the time-delay effect is ignored, and the second is a Posi-Cast controller which explicitly accounts for the delay. Injection at the burning zone and further upstream is considered. The characteristics of fuel injectors including bandwidth, authority (pulsed-fuel flow rate), and whether it applies a proportional or a two-position (on-off) injection are discussed. We show that increasing authority and bandwidth result in improved performance. Injection further upstream compared to the burning zone results in a trade-off between improved mixing and increased time-delay. We also note that proportional injection is more successful than on-off injection since the former can modulate both amplitude and phase of the control fuel.
Author
Fuel Injection; Active Control; Combustion Stability; Optimal Control; Numerical Analysis

20010067741 Virginia Polytechnic Inst. and State Univ., Blacksburg, VA USA
AN INVESTIGATION OF ADAPTIVE SIGNAL PROCESSING APPROACHES TO ACTIVE COMBUSTION CONTROL
Vaudrey, Michael A., Virginia Polytechnic Inst. and State Univ., USA; Saunders, William R., Virginia Polytechnic Inst. and State Univ., USA; Baumann, William T., Virginia Polytechnic Inst. and State Univ., USA; Active Control Technology for Enhanced Performance Opera-

tional Capabilities of Military Aircraft, Land Vehicles and Sea Vehicles; June 2001, pp. 24-1 - 24-12; In English; See also 20010067671; Copyright Waived; Avail: CASI; A03, Hardcopy

There has been significant progress made in understanding dynamic models and control system designs for active control of thermoacoustic instabilities. During the past several years, there has been an increasing trend away from mostly empirical or experimentally-based active combustion control (ACC) methods in exchange for control systems that rely on more accurate understanding of the dynamic processes involved in the thermoacoustic limit cycling response. Early demonstrations of phase-shifting ACC designs relied simply on a measurement of the acoustic pressure and actuation of the unsteady heat release after appropriate delay (i.e., phase shift) relative to the measured pressure signal. The phase-shifting controllers proved to be effective in many situations but were plagued by inadequate knowledge of how to predict the required phase, and gain, of the controller for varying operating conditions of the combustor. These problems naturally led to investigations of adaptive control methods. This paper extends the existing research into the design of LMS adaptive filters for suppression of thermoacoustic instabilities. Through detailed numerical simulations, supported by relevant experiments on a simple tube combustor, we provide one possible method for achieving stabilizing control using an adaptive feedback architecture. We carefully distinguish between two fundamental modes of instability that may be responsible for the aberrant behaviors reported by previous researchers. The first mode is related to the generation of feedback instabilities that can arise as the adaptive filter converges to the optimal solution. The second mode is related to convergence of the gradient search algorithm, analogous to the convergence issues that have been presented by Elliott et. al. for Filtered-X or Wang and Ren for Filtered-U. The primary focus of this paper is on the feedback-related instability mode as it appears to be most dominant and may be directly related to the selection of system identification method used for the adaptive filter implementation.

Derived from text

Active Control; Adaptive Control; Adaptive Filters; Signal Processing; Control Systems Design

20010067744 Pennsylvania State Univ., Mechanical Engineering Dept., University Park, PA USA

WIDE-RANGE ROBUST CONTROL OF COMBUSTION INSTABILITY

Hong, Boe-Shong, Pennsylvania State Univ., USA; Yang, Vigor, Pennsylvania State Univ., USA; Ray, Asok, Pennsylvania State Univ., USA; Active Control Technology for Enhanced Performance Operational Capabilities of Military Aircraft, Land Vehicles and Sea Vehicles; June 2001, pp. 28-1 - 28-14; In English; See also 20010067671

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This paper presents the concept and design of a two-layer robust control system for suppression of combustion instabilities over a wide range of operation. The control law synthesis based on a multiple-time-scale model of combustion dynamics. Control actions on the fast-time scale are provided by secondary fuel injection, realized as modulation of the primary fuel flow, and are gain-scheduled according to the variations of mean-flow temperature and velocity on the slow-time scale. A linear parameter varying (LPV) L(sub 2)-gain control law is formulated in the setting of differential game theory. Simulation experiments have been conducted to evaluate the control law under wide-range operation of a generic combustor in terms of the trade-off among: (1) fuel injection rate and pressure oscillation; (2) transient and steady responses; and (3) stability robustness and performance.

Author

Combustion Stability; Control Theory; Numerical Analysis

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REVIEW ON ACTIVITIES IN ACTIVE COMBUSTION CONTROL (ACC) AT THE TECHNISCHE UNIVERSITAET MUENCHEN (TUM)

Gleis, Stephan, Technische Univ. Munich, Germany; Active Control Technology for Enhanced Performance Operational Capabilities of Military Aircraft, Land Vehicles and Sea Vehicles; June 2001, pp. 29-1 - 29-12; In English; See also 20010067671; Copyright Waived; Avail: CASI; A03, Hardcopy

About 30 years ago Professor Dieter Vortmeyer, who has been retired in March 1999, started his research in the field of acoustic instabilities in combustion systems and began the research in active combustion control in 1986. To the honor of Prof. Vortmeyer herewith a review on his work in the field of ACC is given.

Author

Acoustic Instability; Active Control; Combustion

20010067746 United Technologies Research Center, East Hartford, CT USA

ACTIVE CONTROL OF COMBUSTION INSTABILITIES IN GAS TURBINE ENGINES FOR LOW EMISSIONS, PART 1, PHYSICS-BASED AND EXPERIMENTALLY IDENTIFIED COMBUSTION INSTABILITY

Jacobson, C. A., United Technologies Research Center, USA; Khibnik, A. I., United Technologies Research Center, USA; Banaszuk, A., United Technologies Research Center, USA; Cohen, J., United Technologies Research Center, USA; Proscia, W., United Technologies Research Center, USA; Active Control Technology for Enhanced Performance Operational Capabilities of Military Aircraft, Land Vehicles and Sea Vehicles; June 2001, pp. 30-1 - 30-12; In English; See also 20010067671; Copyright Waived; Avail: CASI; A03, Hardcopy

This paper details the development of a thermoacoustic model and associated dynamic analysis. The model describes the results obtained in a gas fueled experimental combustion program carried out at UTRC (United Technologies Research Center). The contents of the paper are: (1) the development of a thermoacoustic model composed of acoustic and heat release components; (2) the dynamic analysis of the resulting nonlinear model using harmonic balance methods to compute linear stability boundaries and the amplitudes of oscillations; and (3) the calibration of the model to experimental data.

Author

Active Control; Combustion Stability; Thermoacoustic Effects

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ACTIVE CONTROL OF COMBUSTION INSTABILITIES IN GAS TURBINE ENGINES FOR LOW EMISSIONS, PART 2, ADAPTIVE CONTROL ALGORITHM DEVELOPMENT, DEMONSTRATION AND PERFORMANCE LIMITATIONS

Banaszuk, Andrzej, United Technologies Research Center, USA; Zhang, You-Ping, Numerical Technologies, Inc., USA; Jacobson, Clas A., United Technologies Research Center, USA; Active Control Technology for Enhanced Performance Operational Capabilities of Military Aircraft, Land Vehicles and Sea Vehicles; June 2001, pp. 31-1 - 31-13; In English; See also 20010067671; Original contains color illustrations

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We present results of experiment with two distinct extremum-seeking adaptive algorithms for control of combustion instability suitable for reduction of acoustic pressure oscillations in gas turbine over large range of operating conditions. The algorithm consists of a frequency tracking Extended Kalman Filter to determine the in-phase component, the quadrature component, and the magnitude of the acoustic mode of interest, and a phase shifting controller with the controller phase tuned using an extremum-seeking algorithms. The algorithms are also applicable for control of oscillations of systems whose oscillation frequency and optimal control phase shift depends on operating conditions, and which are driven by strong broad-band disturbance. The algorithms have been tested in combustion experiments involving full-scale engine hardware and during simulated fast engine transients.

Author

Active Control; Adaptive Control; Algorithms; Combustion Stability; Harmonic Oscillation

20010067751 Pennsylvania State Univ., Dept. of Mechanical and Nuclear Engineering, University Park, PA USA

OPTIMIZATION OF ACTIVE CONTROL SYSTEMS FOR SUPPRESSING COMBUSTION DYNAMICS

Kim, Kwanwoo, Pennsylvania State Univ., USA; Lee, Jong-Guen, Pennsylvania State Univ., USA; Stenzler, Jacob, Pennsylvania State

Univ., USA; Santavicca, Domenic A., Pennsylvania State Univ., USA; Active Control Technology for Enhanced Performance Operational Capabilities of Military Aircraft, Land Vehicles and Sea Vehicles; June 2001, pp. 35-1 - 35-9; In English; See also 20010067671
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Results from an experimental study of active combustion control using modulated secondary fuel on a laboratory-scale, lean premixed dump combustor are presented. A simple phase-delay, closed-loop controller was used for these tests operating at the fourth subharmonic of the dominant frequency of the instability. Tests were conducted using both natural gas and Jet-A as the secondary fuel and the results are compared. Of particular interest are the observed differences in control effectiveness and the causes of those differences.
Author
Active Control; Fuel Combustion; Optimization; Combustion Control

20010067752 Maryland Univ., Aerospace Engineering Dept., College Park, MD USA
AN EXPERIMENTAL STUDY ON ACTIVELY CONTROLLED DUMP COMBUSTORS
Yu, K., Maryland Univ., USA; Wilson, K. J., Naval Air Warfare Center, USA; Parr, T. P., Naval Air Warfare Center, USA; Schadow, K. C., Naval Air Warfare Center, USA; Active Control Technology for Enhanced Performance Operational Capabilities of Military Aircraft, Land Vehicles and Sea Vehicles; June 2001, pp. 36-1 - 36-17; In English; See also 20010067671; Original contains color illustrations; Copyright Waived; Avail: CASI; A03, Hardcopy

A closed-loop liquid-fueled active control technique was applied in a dump combustor to enhance its combustion performance. Practical issues involving liquid fuel, scaling effects, and affordable control methods were studied experimentally. The results shed new light on the requirement of critical fuel flux, effects of fuel droplet size on control, and novel controller concepts that would help the future development work. The critical fuel flux was found to be dependent on the fuel droplet size and initial magnitude of the instabilities. When the fuel droplet size, D(sub 0), was reduced in the controlled injection, the control efficiency for heat flux actuation increased significantly. The analysis yielded an exponential dependency on the droplet size. For a moderate droplet Reynolds number considered in this study, the amplitude of controlled heat release for a given fuel amount was inversely proportional to the droplet size by a factor of D(sub 0)(exp -1.4). Also, two novel controller concepts, which incorporated practical designs, were tested and were shown to work effectively compared to the baseline case. One of the concepts was based on injecting fuel pulses at sub-harmonic frequencies of the instability, thus addressing the limited actuator frequency response. The other concept utilized both open-loop and closed-loop control schemes to obtain enhanced performance including extension of the stable combustion zone. These results open up the possibility of applying the active combustion control technology to advanced propulsion devices.
Author
Active Control; Dump Combustors; Drop Size; Combustion Stability; Combustion Control

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METALS AND METALLIC MATERIALS

19990026320 Research and Technology Organization, Applied Vehicle Technology Panel, Neuilly-sur-Seine, France
FATIGUE IN THE PRESENCE OF CORROSION *[FATIGUE SOUS CORROSION]*
Fatigue in the Presence of Corrosion; March 1999; 214p; In English; 7-9 Oct. 1998, Corfu, Greece; See also 19990026321 through 19990026338; Original contains color illustrations
Report No.(s): RTO-MP-18; AC/323(AVT)TP/8; ISBN 92-837-1011-8; Copyright Waived; Avail: CASI; A10, Hardcopy; A03, Microfiche

The NATO fleets are aging in both real time and in accrued fatigue damage. Corrosion and fatigue, independently, are high cost maintenance items and both can affect airworthiness. There is a synergistic relationship between these two phenomena. Cost effective and airworthy approaches to design and corrosion prevention must be defined. Work in NATO countries could be accelerated by a sharing of experience. During the Workshop 22 papers were grouped in four sessions: Session 1, In-service Experience with Corrosion Fatigue; Session 2, Simulation/Test Evaluation Programs; Session 3, Fatigue Prediction Methodologies in Corrosive Environments; and Session 4, Structural Integrity - Corrosion and Fatigue Interactions.
Author
Fatigue (Materials); Corrosion; Service Life; Aircraft Maintenance; Corrosion Prevention; Aircraft Structures; Structural Failure; Nondestructive Tests

19990026327 Aerospatiale, Suresnes, France
CORROSION FATIGUE OF ALUMINUM ALLOYS: TESTING AND PREDICTION
Genkin, J.-M., Aerospatiale, France; Journet, B. G., Aerospatiale, France; Fatigue in the Presence of Corrosion; March 1999; 12p; In English; See also 19990026320; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

Since the Aloha in-flight failure, the aging aircraft issue has prompted some renewed effort from the research community in the area of corrosion fatigue. This paper presents a methodology which deals with corrosion fatigue crack initiation in a pitting environment. The investigation is carried out on an aluminum lithium alloy. The obtained results shed a new light on the understanding of corrosion fatigue. Before corrosion fatigue cracks take over, the propagating flaw is a hybrid half pit / half corrosion fatigue crack. Both pitting and corrosion fatigue contribute to the flaw growth. A predictive model has been derived. The validation was made by comparing the predictions to experimentally measured pit depths and fatigue lives. A set of guidelines is given for the prediction of in-service corrosion fatigue. It highlights the materials parameters to be evaluated and the testing conditions to use.
Author
Metal Fatigue; Corrosion; Structural Failure; Aircraft Maintenance; Aluminum Alloys; Aircraft Structures; Pitting; Lithium Alloys; Cracks; Corrosion Tests

19990026328 La Sapienza Univ., Rome, Italy
INFLUENCE OF CORROSION ON FATIGUE CRACK GROWTH PROPAGATION OF ALUMINIUM LITHIUM ALLOYS
Brotzu, A., La Sapienza Univ., Italy; Cavallini, M., La Sapienza Univ., Italy; Felli, F., La Sapienza Univ., Italy; Marchetti, M., La Sapienza Univ., Italy; Fatigue in the Presence of Corrosion; March 1999; 12p; In English; See also 19990026320; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

The fatigue crack propagation behaviour of three commercial Al-Li alloys (2091, 8090, and Weldalite(R) 049), supplied by the manufacturer in form of plate, have been studied. A great number of the test have been carried out in order to obtain a reliable set of data. The tests were conducted in air and 3.5%w NaCl aqueous solution at different frequencies (1, 2, 5 and 10 Hz). Fractographic examinations with a scanning electron microscope and a particular etching technique have been done in order to isolate the possible fatigue mechanisms.
Author
Fatigue (Materials); Corrosion; Aluminum Alloys; Corrosion Tests; Lithium Alloys; Crack Propagation; Fatigue Tests; Aircraft Structures

19990026329 Aluminum Co. of America, Alcoa Center, PA USA
EFFECT OF PRIOR CORROSION ON FATIGUE PERFORMANCE OF TOUGHNESS IMPROVED FUSELAGE SKIN SHEET ALLOY 2524-T3
Bray, G. H., Aluminum Co. of America, USA; Bucci, R. J., Aluminum Co. of America, USA; Golden, P. J., Purdue Univ., USA; Grandt, A. F., Purdue Univ., USA; Fatigue in the Presence of Corrosion; March 1999; 9p; In English; See also 19990026320; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

Aviation industry demand for continuous safety improvement in the face of trends toward increasing service life of aircraft and cost control necessitates stronger prevention and control measures to avoid the likelihood of structural failures linked to multi-site damage (MSD) involving corrosion and fatigue. New materials with improved damage tolerance attributes can improve the margin of safety in the presence of MSD. An excellent example of one such material is new aluminum alloy 2524 (formerly C188). In this study, the effect of prior pitting corrosion on the S/N fatigue performance of thin (< or = 3.17

mm) 2524-T3 and 2024-T3 bare sheet was evaluated in a two part study. First, smooth axial fatigue specimens were corroded by accelerated methods to approximate 1 yr seacoast exposure and then fatigue tested in lab air. The fatigue strength of 2524 was approximately 10% greater and the lifetime to failure 30 to 45% longer than that of 2024. Second, panels containing 24 open holes were similarly corroded and then fatigued in lab air for 100,000 cycles. The mean flaw areas following corrosion and fatigue were 18% smaller in 2524 and the corroded area alone 32% smaller. The results of this study indicate that thin, bare 2524 sheet is more resistant to MSD from pitting corrosion than thin, bare 2024 sheet. Alloy 2524 also offers improved structural damage tolerance in the presence of MSD due to its superior fatigue crack growth resistance and fracture toughness.
Author
Fatigue (Materials); Corrosion; Structural Failure; Aluminum Alloys; Crack Propagation; Metal Sheets; Pitting; Fuselages; Skin (Structural Member); Fatigue Tests

19990026330 Daimler-Benz Aerospace A.G., Fatigue and Fracture Mechanics Dept., Hamburg, Germany
THE EFFECT OF ENVIRONMENT: DURABILITY AND CRACK GROWTH
Schmidt-Brandecker, B., Daimler-Benz Aerospace A.G., Germany; Schmidt, H.-J., Daimler-Benz Aerospace A.G., Germany; Fatigue in the Presence of Corrosion; March 1999; 9p; In English; See also 19990026320; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

Structures of transport aircraft are to be designed for an optimum of weight, costs and performance. Amongst others this requires the investigation of the durability and the damage tolerance behavior of the structure. Both characteristics are significantly influenced by the environmental conditions. Additionally the load frequency has an effect on the crack growth behavior of aluminium structure. These aspects play a major role during the material selection for the next Airbus aircraft generation. For the fuselage of the planned Airbus Megaliner new materials are under consideration to comply with the forthcoming regulations and to reduce the production costs. This paper describes the results of crack growth and crack initiation tests of several aluminium alloys under varying environment and loading frequency.
Author
Fatigue (Materials); Corrosion; Aircraft Reliability; Aluminum Alloys; Crack Initiation; Crack Propagation; Aircraft Structures; Environmental Tests; Transport Aircraft; Loads (Forces)

19990026331 Hellenic Aerospace Industry, Advanced Materials and Processes Dept., Schimatari, Greece
COMBINED EFFECT OF HYDROGEN AND CORROSION ON HIGH STRENGTH AIRCRAFT STRUCTURES UNDER STRESSED CONDITIONS
Marioli-Riga, Z. P., Hellenic Aerospace Industry, Greece; Karanika, A. N., Hellenic Aerospace Industry, Greece; Fatigue in the Presence of Corrosion; March 1999; 10p; In English; See also 19990026320; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

The embrittlement of high strength landing gear steels is attributed to hydrogen absorption during electro-chemical corrosion protection treatments. Accidents have been reported after service of high strength landing gear components at low applied cycles of stresses and have been attributed to Hydrogen Embrittlement. For evaluation of the mechanical properties reduction of high strength structures, after retreatment during maintenance, specific sustained load creep tests are carried out. When an electrochemical plated notched specimen is strained, hydrogen is carried by mobile dislocations to the root of the notch. Transient cracks formed by dislocation interaction, are stabilized by the hydrogen and stresses which would be relieved by deformation in absence of hydrogen are relieved by cracking when the hydrogen content exceeds a critical value. However, these tests provide information of mechanical behaviour based only to Hydrogen absorption. In real cases the A/C components phases a combined effect of highly corrosive environment like seawater, hydrogen and loading. The present investigation is aimed to create realistic qualification tests for high strength serviced aircraft components operated in a periodical fatigue and corrosive environment. A creep test program was developed and a series of notched specimen attacked variously by Hydrogen and corrosion salt spray have been subjected to different cycles of sustained load. The mechanism of failure was recorded and conclusions were extracted for establishing simulated qualification tests.
Author
Hydrogen Embrittlement; Corrosion; Structural Failure; Aircraft Structures; Environmental Tests; Stress Concentration; Metal Fatigue; Cracks; High Strength Steels; Landing Gear; Load Tests

19990026334 Office of Naval Research, Arlington, VA USA
ENVIRONMENTAL EFFECTS ON FATIGUE CRACK INITIATION AND GROWTH
Vasudevan, A. K., Office of Naval Research, USA; Sadananda, K., Naval Research Lab., USA; Fatigue in the Presence of Corrosion; March 1999; 13p; In English; See also 19990026320; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

This article discusses briefly the relative effects of the role of environment on the fatigue crack initiation and growth at ambient temperatures. Emphasis is given to describe the crack tip driving forces required to understand the basic physics. It is observed that the fatigue damage requires two driving force parameters (Delta-K and K(max)) over the entire range and that the relative role of each parameter depends strongly on the role of deformation slip and environment. The environmental effects fall into four categories that depend on the synergistic role of the environmental kinetics and deformation. The study points out that one needs the correct parameters to develop a life prediction model. The overall topics are focussed to the near threshold behavior and the concepts can be extended to higher growth rates.
Author
Fatigue (Materials); Corrosion; Structural Failure; Crack Initiation; Aircraft Reliability; Crack Propagation; Crack Tips; Environmental Tests

19990026335 Defence Evaluation Research Agency, Structural Materials Centre, Farnborough, UK
ROLE OF SURFACE PITTING CORROSION ON EFFECTIVENESS OF HOLE COLD EXPANSION
Cook, R., Defence Evaluation Research Agency, UK; Glinos, N., Kingston Univ., UK; Wagstaff, P., Kingston Univ., UK; Fatigue in the Presence of Corrosion; March 1999; 12p; In English; See also 19990026320; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

Fatigue tests have been carried out on open hole specimens which have been cold expanded prior to or subsequent to exposure to corrosive environments. The results show that the effectiveness of hole cold expansion in enhancing fatigue endurance can be significantly reduced when cold expansion is carried out after exposure to corrosive environments. The reduction in effectiveness is associated with a change in failure location. In specimens cold expanded after exposure to corrosion, failures initiate from pits remote from the hole in an area of tensile residual stresses. Analytical models have been developed to predict the rate of crack growth from these corrosion pits which correlate well with experimental data. Models have also been developed to predict the rate of growth of cracks from cold expanded holes which show reasonable correlation with experimental data. The findings have important implications to the aircraft industry where corrosion problems can be serious and where hole cold expansion is frequently employed in repair schemes.
Author
Fatigue Life; Corrosion; Structural Failure; Crack Propagation; Fatigue Tests; Holes (Mechanics); Mathematical Models; Pitting; Expansion

19990026336 Institute for Aerospace Research, Structures Materials and Propulsion Lab., Ottawa, Ontario Canada
AN EXPERIMENTAL STUDY OF CORROSION/FATIGUE INTERACTION IN THE DEVELOPMENT OF MULTIPLE SITE DAMAGE IN LONGITUDINAL FUSELAGE SKIN SPLICES
Eastaugh, Graeme F., Institute for Aerospace Research, Canada; Merati, Ali A., Institute for Aerospace Research, Canada; Simpson, David L., Institute for Aerospace Research, Canada; Straznicky, Paul V., Carleton Univ., Canada; Scott, Jason P., Carleton Univ., Canada; Wakeman, R. Brett, Carleton Univ., Canada; Krizan, David V., Carleton Univ., Canada; Fatigue in the Presence of Corrosion; March 1999; 16p; In English; See also 19990026320; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

It is difficult and costly to study either the fatigue or the

corrosion/fatigue behaviour of longitudinal fuselage splices using in-service aircraft or full-scale structural test articles. These studies are further complicated by variations in splice designs in different types of aircraft. Therefore, a means of performing representative experimental studies cost-effectively for different aircraft has been devised. A special uniaxial specimen developed earlier has been used to simulate the stress environment of an aircraft splice. This specimen is capable of providing representative fatigue crack initiation, growth, and link-up data for the typical multiple site damage (MSD) failure mode and for other crack scenarios. In-service corrosion has been simulated by applying an accelerated corrosion process to the interior of the splice without damaging other areas of the specimen. Combined exposure to both corrosion and fatigue has so far been simulated by pre-corroding, drying and then fatigue testing the specimen. The accelerated corrosion damage in MSD specimens has been compared with natural corrosion damage in aircraft splices and the overall experimental approach is considered to be adequately representative for an initial study of the effects of corrosion on the durability and damage tolerance characteristics of fuselage splices. The preliminary results of an exploratory test programme indicate that corrosion at levels found in some aircraft could significantly reduce the fatigue life of longitudinal fuselage splices and could cause important changes in failure modes.
Author
Corrosion; Structural Failure; Fuselages; Fatigue Life; Fatigue Tests; Failure Modes; Crack Initiation; Splicing; Aircraft Structures

19990070397 Technische Univ., Inst. fuer Werkstoffe, Brunswick, Germany
LIFE EXTENSION OF IN706 TYPE DISC MATERIALS BY SURFACE MODIFICATION WITH BORON
Roesler, J., Technische Univ., Germany; Mueller, S., Technische Univ., Germany; March 1999; 8p; In English; See also 19990070390; Copyright Waived; Avail: CASI; A02, Hardcopy; A02, Microfiche

A novel process is described which is capable of protecting Ni-Base superalloys against stress accelerated grain boundary oxidation (SAGBO) by chemical modification of a surface zone with boron. The potential of the proposed technique in extending the lifetime of wrought Ni-base alloys is discussed performing creep crack growth, constant strain rate and Life cycle fatigue (LCF) experiments at 600C and 700C. Significant life extension under static loading condition is demonstrated. Under cyclic loading care has to be taken to avoid brittle boride layers on the component surface to make full use of the protective effect against SAGBO.
Author
Boron; Crack Propagation; Creep Properties; Cyclic Loads; Oxidation; Strain Rate; Wrought Alloys; Nickel Alloys; Heat Resistant Alloys; Grain Boundaries; Static Loads; Crack Arrest

20000047267 Elektroniksystem- und Logistik G.m.b.H., Munich, Germany
CADMIUM, A HEALTH HAZARD SURFACE TREATMENT
Rehm, C., Elektroniksystem- und Logistik G.m.b.H., Germany; Approaches to the Implementation of Environment Pollution Prevention Technologies at Military Bases; April 2000, pp. 4-1 - 4-20; In English; See also 20000047263; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

The use of materials involving health risks represents a health risk in general and an environmental risk. In some instances restrictions have been imposed on the marketing of materials that are injurious to health and on the use of specific hazardous materials and their processing. This is the case with asbestos, PCB/PCT, cadmium and cadmium alloys, etc. These restrictions are published within the European Union in what are known as EEC Directives (EEC 76/769). If individual countries within the European Union wish to adopt these restrictions, these restrictions have to be implemented by passing legislation at a national level. Implementation of this EEC Directive under German law resulted in the Chemicals Prohibitory Regulation (Chemikalien-Verbotsverordnung). Thus, for example, cadmium and its alloys must not be marketed pursuant to this EEC Directive and the Chemicals Prohibitory Regulation. However, the present legal situation does allow a few exceptions. One exception, for example, is aerospace, where cadmium may still be brought into circulation and used. This affects the military sector to an equal extent. Cadmium is still used today for surface treatment (corrosion protection) in a large number of weapon systems. Hazards to humans and the environment arise from cadmium in the following specific processes: (1) manufacturing (electroplating processes); (2) maintenance and repair jobs; and (3) disposal, of course.
Derived from text
Cadmium; Hazardous Materials; Materials Handling

20000047293 Kawasaki Heavy Industries Ltd., Gifu, Japan
STUDIES ON LONG TERM DURABILITY OF ALUMINUM AIRFRAME STRUCTURE MADE BY AFFORDABLE PROCESS
Hira, Hirohito, Kawasaki Heavy Industries Ltd., Japan; Yoshino, Yasuaki, Kawasaki Heavy Industries Ltd., Japan; New Metallic Materials for the Structure of Aging Aircraft; April 2000, pp. 11-1 - 11-7; In English; See also 20000047290; Copyright Waived; Avail: CASI; A02, Hardcopy

Affordability is one of the most important problems of today's development of airframe especially for aluminum alloy application. Some new aluminum alloys and improved processes are being applied to production cost reduction, and tests related to long term durability of applied structures are also carried out. In this report, our recent studies of following three affordable process methods to aluminum alloy structures are introduced, these are outline of process studies and their merits, and mechanical properties, fatigue properties and corrosion resistance. (1) Application of new 6000 series alloy of high formability; (2) Application of premium precision casting; and (3) Application of superplastic forming.
Author
Research; Durability; Airframes; Aluminum Alloys; Service Life; Mechanical Properties

20000047294 Rome Univ., School of Aerospace Engineering, Rome, Italy
PLASTIC ENVELOPE IN PROPAGATING CRACK WAKE ON AL-LI ALLOYS SUBJECTED TO FATIGUE CYCLES AND TO DIFFERENT HEAT TREATMENTS
Corradi, S., Rome Univ., Italy; Marchetti, M., Rome Univ., Italy; Stellino, W., Rome Univ., Italy; New Metallic Materials for the Structure of Aging Aircraft; April 2000, pp. 12-1 - 12-13; In English; See also 20000047290; Copyright Waived; Avail: CASI; A03, Hardcopy

The aim of this research is to study the fracture behaviour of three Al-Li alloys (2091-21958090), using standard CT specimens, in the frequency range of 1-10 Hz. Each of these three alloys is subjected to different heat treatments and its homogeneity is analysed, before and after treatments, by Scanning Electron Microscope (SEM). Crack tip opening displacements and plastic zone envelope analyses are fully treated by experimental and numerical results and fatigue crack growth process is extensively reported. At the end of fatigue tests, specimen fracture surfaces have been deeply analysed by SEM in order to individualize the characteristics of fracture as function of frequency, AK and load ratio R.
Author
Crack Propagation; Wakes; Aluminum Alloys; Lithium Alloys; Fatigue Tests; Fracture Mechanics; Heat Treatment; Metal Fatigue

20000047296 Institute for Aerospace Research, Structures, Materials and Propulsion Lab., Ottawa, Ontario Canada
RRA HEAT TREATMENT OF LARGE AL 7075-T6 COMPONENTS
Holt, R. T., Institute for Aerospace Research, Canada; Raizenne, M. D., Institute for Aerospace Research, Canada; Wallace, W., Institute for Aerospace Research, Canada; DuQuesnay, D. L., Royal Military Coll. of Canada, Canada; New Metallic Materials for the Structure of Aging Aircraft; April 2000, pp. 7-1 - 7-11; In English; See also 20000047290; Copyright Waived; Avail: CASI; A03, Hardcopy

Retrogression and re-aging (RRA) is a heat treatment process performed on the aluminum alloy 7075 in the T6xxx temper condition to improve its resistance to corrosion, while at the same time maintaining the high strength levels required for aircraft structural applications. For large extruded or forged parts, we have determined that the most practical process involves retrogression at 195 C for 40 minutes, followed by rapid cooling and full re-aging at 120 C for 24 hours, After an RRA treatment of a large extrusion (a three-metre section from a CC-130 sloping longeron), we measured a shrinkage of approximately 0.01S%, with minimal distortion damage. There is a small loss of strength, e.g. the RRA yield strength is typically 5 15 MPa compared to 530 MPa for the same material in the T-6

condition. The corrosion resistance measured both by exfoliation and stress corrosion cracking are significantly better than for the T-6 condition and approach that for the over-aged T-73 condition. Furthermore, the fatigue resistance and fracture toughness of RRA treated material are both within the scatter bands for the T6 condition. For many thick section extrusions and forgings, rework specifications allow for the removal of up to 10% of the material thickness to remove service-exposed corrosion damage (after which the part must be replaced). Hence, the small penalty in strength experienced after the RRA treatment is more than compensated for by improved corrosion resistance, which can eliminate the need to remove corroded material.
Author
Heat Treatment; Aluminum Alloys; Corrosion Resistance; Yield Strength; Stress Corrosion Cracking; Aircraft Structures

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NONMETALLIC MATERIALS

19990070398 Rolls-Royce Ltd., Bristol, UK
TBC AND OTHER SURFACE COATINGS: BENEFITS AND LIFING PROCEDURES
Shaw, D. L., Rolls-Royce Ltd., UK; March 1999; 8p; In English; See also 19990070390; Copyright Waived; Avail: CASI; A02, Hardcopy; A02, Microfiche

For the past two decades, thermal barrier coatings (TBC) have offered the promise of increased turbine capability in terms of increased temperature or reduced cooling flows. They have also held out the promise of life extension to existing hot end components by offering simple solutions to localised cooling problems. These goals have remained tantalizingly unattainable. That their potential is now within reach, is largely a result of the development of successful lifing methodologies. These lifing methodologies have identified the significant design parameters and enabled the development of process parameters that have ensured the survival of the coating for acceptable life attainment on both new and refurbished components. The lifing methodologies have highlighted the significance of the bond coat in ensuring coating integrity in terms of cracking, spallation and cyclic behaviour.
Author
Spallation; Thermal Control Coatings; Design Analysis; Cooling; Life (Durability); Failure Analysis; Plasma Spraying; Vapor Deposition; Cracking (Fracturing)

19990102976 Purdue Univ., School of Aeronautics and Astronautics, West Lafayette, IN USA
SURFACE MEASUREMENT TECHNIQUES TEMPERATURE AND PRESSURE SENSITIVE PAINTS
Sullivan, John P., Purdue Univ., USA; Liu, Tian-Shu, Purdue Univ., USA; Planar Optical Measurement Methods for Gas Turbine Components; September 1999, pp. 5-1 - 5-14; In English; See also 19990102970; Copyright Waived; Avail: CASI; A03, Hardcopy; A02, Microfiche; US Distribution and Sales Only

Luminescent molecular probes imbedded in a polymer binder form a temperature or pressure paint. On excitation by light of the proper wavelength, the luminescence,which is quenched either thermally or by oxygen, is detected by a camera or photodetector. From the detected luminescent intensity, temperature and pressure can be determined. TI e basic photophysics, calibration, accuracy and the response of a luminescent paints is described followed by applications in wind tunnels and in rotating machinery.
Author
Procedures; Surface Temperature; Paints; Wavelengths; Pressure Measurement

20000047284 Norwegian Defence Research Establishment, Div. for Environmental Toxicology, Kjeller, Norway
CONTAMINATION FROM MARINE PAINTS: A NORWEGIAN PERSPECTIVE
Johnsen, Arnt, Norwegian Defence Research Establishment, Norway; Engoy, Thor, Norwegian Defence Research Establishment, Norway; Approaches to the Implementation of Environment Pollution Prevention Technologies at Military Bases; April 2000, pp. 23-1 - 23-6; In English; See also 20000047263; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

Marine paints have been used for over 100 years to protect ships from weathering and biological and chemical degradation. In order to obtain the right marine paint quality various substances increasing the anticorrosive, antifouling, mechanical flexibility, weatherability, chemical and cold resistance properties were added. Many of the additives that have been used and are still being used today are toxic compounds for man and other species. Spills of paint residues and leakage from painted objects will eventually be deposited in the sea sediments and will therefore potentially pose a threat to the marine environment. Biocides and various other additives used in antifouling paints seem to give the most serious problems ranked according to impact on marine life. Antifouling paints are designed to give a thin boundary layer in the water around the hull were the concentration of antifouling agent is high enough to kill algae and other organisms that would otherwise remain attached to the hull. With the water acting as a sink, there will therefore need to be a continuous release of toxic compounds from the hull. These compounds have high affinity to particles in the water column and will therefore quickly settle on the seabed. Contaminated sediment will subsequently be a source for resuspension or dissolution in the water column or a direct source for bottom feeders. In Norway a majority of harbours and areas adjacent to main ship repair yards have highly contaminated sediments. This has resulted in elevated levels of toxic compounds in fish and shellfish living in these waters and guidance on their consumption has been issued by the Norwegian Food Control Authority. In many cases the prime concern is the elevated levels of PCBs (Poly Chlorinated Biphenyls). At Haakonsvem Naval Base the Norwegian Defence Construction Service has commenced actions to remove contaminated sediment. The sources of some of these contaminants, such as TBT (tributyltin) have been firmly established to be antifoulants due to its unique application. However other contaminant sources remain elusive, such as PCBs, in part due to the mixing of multiple source signals over a period of several decades, in part due to the limited accessibility of the composition of historical and contemporary marine paints. An investigation into the link between contaminant concentration in sediments at Haakonsvem Naval Base and the use of marine paints is presented here.
Author
Marine Environments; Environment Protection; Paints; Sediments; Ship Hulls; Pollution Control

20000047286 Army Armament Research, Development and Engineering Center, Industrial Ecology Center, Picatinny Arsenal, NJ USA
ENVIRONMENTALLY COMPATIBLE COATING REMOVAL FOR WEAPON SYSTEMS
Zanowicz, Robert, Army Armament Research, Development and Engineering Center, USA; Approaches to the Implementation of Environment Pollution Prevention Technologies at Military Bases; April 2000, pp. 26-1 - 26-14; In English; See also 20000047263; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

The U.S. Department of Defense's depot and sustainment activities produces large amounts of hazardous waste each year in the re-furbishment of all types of military equipment. These include but are not limited to tanks, combat ground vehicles, ships, aircraft and their associated armament. Budgets for new materiel acquisition in all the services have dropped substantially since the early 1990s and services are committed to holding on to their existing inventories of equipment. In one example, the Air Force B-52 Bomber will remain in service until the 2030's, extending its life cycle to over 90 years. Right now the U.S. is postured in a position to maintain its aging inventory of legacy system equipment. There is no doubt that many pieces of equipment will go through many Rework cycles until it is placed in surplus. Coupled to the fact that since the end of the Cold War, the U.S. Military has been subject to stringent air and water pollution control through legislation and executive order. The military services which operate the shipyards, air logistics centers and depots now face the two fold challenge of a vastly increased workload and much stricter environmental guidelines of which to operate. In addition, many Government Owned, Government Operated depots face endless cost cutting challenges from outsourcing in the private sector to remain open. Many of these maintenance operations involve paint stripping and re-painting of vehicles and aircraft. Other operations involve coating removal of inorganic coatings such as those in engines and other assemblies such as landing

gear. For example, it is estimated that 80% of the Air Force hazmats are created by painting and de-painting operations alone. Both the Army and the Navy employ extensive means to their painting and stripping operations. These until recently involve conventional means of paint stripping and coating removal that involve chemical and mechanical means. Chemical means using methylene chloride requires elaborate compliance means such as air emissions controls and filtering systems. Occupational health and safety issues are also considered in that personnel must wear protective equipment and receive the proper Hazmat training. In addition, permits must be obtained and inspections by many state agencies in which the depots operate. Another important point is that many states, in this case California has air emission standards that are far stricter than Federal ones. This is especially true of the SouthCoast Air Emission Standards around the Los Angeles basin and also further south in San Diego. For example, it not uncommon to for the Marines to move trucks and equipment to a neighboring states to strip and paint these vehicles. Again this takes additional time and will increase costs of operations. Hazmats must be stored, cataloged and disposed of properly. Depots are subject to inspections and must comply with paperwork and all this adds up to increased costs of operation. The traditional approach to the environment is to focus on complying with the law and to clean up wastes that were generated throughout the years. All of this is fine but it can be somewhat shortsighted in that all things being equal, unless one changes the process, hazardous materials will continue to be generated. In short, compliance and clean up costs will always remain if not grow due to future legislation. The key is in source reduction by initial elimination or reduction of chemicals. Solutions must also go beyond the environmental compliance issues in that they must make economic sense and have relatively short payback periods.
Derived from text
Paint Removal; Weapon Systems; Pollution Control; Military Operations; Protective Coatings; Hazardous Materials

20000047295 Defence Evaluation Research Agency, Mechanical Sciences Sector, Farnborough, UK
ADVANCES IN PROTECTIVE COATINGS AND THEIR APPLICATION TO AGEING AIRCRAFT
Smith, C. J. E., Defence Evaluation Research Agency, UK; Higs, M. S., Defence Evaluation Research Agency, UK; Baldwin, K. R., Defence Evaluation Research Agency, UK; New Metallic Materials for the Structure of Aging Aircraft; April 2000, pp. 15-1 - 15-8; In English; See also 20000047290; Copyright Waived; Avail: CASI; A02, Hardcopy

Significant improvements have been achieved in the performance of coatings used in the corrosion protection of military and civil aircraft during the last thirty years. Research into aircraft paints, for example, has resulted in coatings with increased adhesion, fluid resistance and greater flexibility. New methods of paint stripping and novel processes for the repair of pre-treatments and metal coatings are being developed which will lead to reductions in the cost of corrosion maintenance and improved levels of protection. The paper reviews recent developments in aerospace coatings and considers their application in ameliorating some of the corrosion problems associated with ageing aircraft.
Author
Protective Coatings; Aging (Materials); Corrosion Prevention; Metal Coatings; Maintenance; Civil Aviation

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PROPELLANTS AND FUELS

20000020843 Karlsruhe Univ., Lehrstuhl und Inst. fuer Thermische Stroemungsmaschinen, Germany
VALIDATION AND APPLICATION OF A DROPLET EVAPORATION MODEL FOR REAL AVIATION FUEL
Prommersberger, K., Karlsruhe Univ., Germany; Maier, G., Karlsruhe Univ., Germany; Wittig, S., Karlsruhe Univ., Germany; Gas Turbine Engine Combustion, Emissions and Alternative Fuels; June 1999, pp. 16-1 - 16-13; In English; See also 20000020829
Contract(s)/Grant(s): DFG-SFB-167; Copyright Waived; Avail: CASI; A03, Hardcopy; A06, Microfiche

Fuel droplet dispersion and evaporation within the premix duct of a Lean Premixed Prevaporized (LPP) combustor is investigated both experimentally and numerically with a two phase flow code. Mean droplet velocity and diameter distribution have been measured in different axial planes with a Phase Doppler Particle Analyzer. The data of the droplet and gas flow measurements near the nozzle is used to establish the boundary conditions for the simulation. The two phase flow is calculated using a Lagrangian type particle tracking method. For the first time an evaporating fuel spray is simulated by the Distillation Curve evaporation model. Based on fuel property data, this model allows the consideration of the multicomponent behavior of aviation fuels. Downstream measurements of droplet size, volume flux and velocity are compared with the numerical results. The objective of the study is to present the simulation of a fuel spray evaporation process inside a LPP duct with reasonable computational effort. The numerical calculation of spray propagation and evaporation demonstrates, that the Distillation Curve evaporation model is able to cover typical multicomponent behavior of aviation fuels under realistic operating conditions. The comparison with the experimental data shows that for the given high relative velocities between gas phase and droplets secondary droplet breakup has to be taken into account.
Author
Aircraft Fuels; Fuel Sprays; Drop Size; Two Phase Flow; Evaporation; Computerized Simulation; Mathematical Models; Gas Flow; Atomizing

20000020868 Rolls-Royce Ltd., Derby, UK
EUROPEAN EVALUATION OF JP8+100 FUEL AND ITS IMPACT ON ENGINE/FUEL SYSTEM DESIGN
Bullock, S. P., Rolls-Royce Ltd., UK; Hobday, A., Rolls-Royce Ltd., UK; Lewis, C., Rolls-Royce Ltd., UK; Gas Turbine Engine Combustion, Emissions and Alternative Fuels; June 1999, pp. 45-1 - 45-11; In English; See also 20000020829; Copyright Waived; Avail: CASI; A03, Hardcopy; A06, Microfiche

High performance aircraft use fuel as the primary heat sink for airframe power and engine lubrication system cooling. Air cooling incurs severe cost, weight and performance penalties. Current engines therefore use all the heat sink capability of the fuel and consequently stress the fuel throughout the system. The resulting high temperatures cause fuel to form deposits reducing system performance and blocking injectors. Advanced engine design calculations indicate that fuel stability will soon become an engine performance limit. The USAF are therefore coordinating the development of additives that enhance thermal/oxidative stability to overcome this limit. These are designated as '+100' signifying the target of improving operating temperature capability by 100 F. Evaluation of these additives has been carried out at RR plc under MOD/DERA funding. Testing so far has evaluated thermal stability enhancement using the Aviation Fuel Thermal Stability Test Unit. This test unit simulates the thermal stresses found in actual fuel system components and injectors. Test modules mimic the responses to fuel deposition found in actual systems to provide prediction of long term performance. Effectiveness of the additive tested was evaluated in blends based on two European fuels of contrasting stability. Testing the additive demonstrated additives provided a significant reduction in deposition compared to base fuel in a variety of regimes. However, blends still had definite stability limits. Results also identified novel operational aspects including additive cleaning effects during transition from normal to additised fuel. Future tests are planned to evaluate alternative additive formulations and expand testing conditions to include mission cycling, reheat system and simulated flow recirculating conditions.
Author
Jp-8 Jet Fuel; Cooling; Engine Design; Fuel Systems; Operating Temperature; Fuel Tests; Thermal Stability; Additives

20000020870 Pisa Univ., Dipt. di Energetica, Italy
MODIFICATION OF THE FUEL CONTROL SYSTEM OF A GAS TURBINE ENGINE FROM KEROSENE TO HYDROGEN
Dini, Dino, Pisa Univ., Italy; Gas Turbine Engine Combustion, Emissions and Alternative Fuels; June 1999, pp. 48-1 - 48-9; In English; See also 20000020829; Copyright Waived; Avail: CASI; A02, Hardcopy; A06, Microfiche

Fuels for engines of road vehicles, as well of boats or aircraft, based on oil derivatives, are well known as essential factors for the air pollution. In order to adapt a gas turbine engine for the lowest emission operation, its fuel control system has to be modified from the use of a hydromechanical kerosene controller (not able to control

gaseous hydrogen) into a digital system for gaseous hydrogen, consisting of an electronic control box which will modulate an electrical/pneumatical valve as a function of engine speed. This is described in the paper, as it has been tested in our laboratory, especially regarding experimental arrangements and measurements. Problems with the ignition of the oxyhydrogen gas have been solved, and the gain factors for the digital control laws were calculated using measured performance data of the kerosene driven engine. Finally, a safe 202 kW gas turbine engine is now running with gaseous hydrogen. Details of the combustion tests of the gaseous hydrogen at the operating performance are given. The data were taken upon pressure losses of the fuel nozzles, ignition performance, temperature distributions at the combustor outlet, combustion efficiency, liner wall temperature distributions, NOx emission level, noise level, operating performance, etc.
Author
Controllers; Electronic Control; Fuel Control; Gas Turbine Engines; Combustion; Hydrogen Fuels; Exhaust Emission; Digital Systems; Environment Effects

20000047276 Rheinmetall G.m.b.H., Duesseldorf, Germany
CONVERSION OF HIGH EXPLOSIVES
Wanninger, P., Rheinmetall G.m.b.H., Germany; Approaches to the Implementation of Environment Pollution Prevention Technologies at Military Bases; April 2000, pp. 14-1 - 14-30; In English; See also 20000047263; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

Military high explosives are realized to provide a propellant (propulsion) or a destructive effect (detonation) in munition. High explosives, rocket propellants or propellant powders hardly ever contain pure high explosives. Normally there are mixtures which have to be split up into their individual components when preparing them for conversion. This is relatively simple in the case of high explosive charges and still feasible for single base propellants but very difficult for double base propellants as they are available in form of solid propellant mixtures. Dissolving and separation of such propellants are very expensive and take much time. An affordable and short-term solution to destroy the high explosives of unexploded ordnance is burning them.
Derived from text
Explosives; Ordnance; Propellants; Combustion; Waste Disposal

20000047277 Ministry of Defence, International Relations Dept., Riga, Latvia
LATVIAN APPROACH TO THE ENVIRONMENTAL ISSUES IN THE MILITARY AREA AND UNEXPLODED ORDNANCE
Gulbis, Andris, Ministry of Defence, Latvia; Approaches to the Implementation of Environment Pollution Prevention Technologies at Military Bases; April 2000, pp. 15-1 - 15-36; In English; See also 20000047263; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

Following 5 decades since the World War II Latvia being occupied sequentially by Nazi and Soviet military powers suffered much from their military presence causing and activating also environmental problems into the places of direct location of German and Soviet troops and their military camps. Extremely high density of former Soviet military units and institutions in Latvia (approx. 700) caused the situation that a lot of dangerous explosives, antipersonnel mines, different emissions, damaged and defected ammunition, other hazardous materials are still polluting vast Latvian rural territories the clearance and neutralisation of whom still challenge the Government being unable to allocate resources sufficient to these needs. Also problems concerning polluted water and soil in former Soviet military sites are not solved yet, then the storage and neutralisation of hazardous waste including dangerous chemicals, petroleum based compounds, rocket fuel, huge stocks of municipal waste left by Soviet army units, polluted sites in Liepaja former military seaport area etc.
Derived from text
Hazardous Materials; Hazardous Wastes; Environment Protection; Environmental Cleanup; Ordnance; Waste Disposal; Latvia

20000047289 Pyrotechnik Silberhutte G.m.b.H., Silberhuette, Germany
DISPOSAL OF PYROTECHNIC ILLUMINATING AND SIGNALLING AMMUNITION
Groeger-Schlink, Martin, Pyrotechnik Silberhutte G.m.b.H., Germany; Approaches to the Implementation of Environment Pollution Prevention Technologies at Military Bases; April 2000, pp. 31-1 - 31-18; In English; See also 20000047263; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

Pyrotechnic illuminating and signalling ammunition is subject to natural aging because of the chemical behavior of the used pyrotechnic compositions and sub-assemblies. For this reason the durability is limited and the use for its purpose is not longer possible because of the safety aspects. From the substance properties of the pyrotechnic compositions in illuminating and signalling ammunition starting points are given which lead the disposal to an environmental friendly, extensive recycling of materials. Started from a short description of the design of illuminating and signalling ammunition and the disposal task the practicise disposal processes are demonstrated in a general view. The exemplary disposal of pyrotechnic ammunitions in the plant of a German enterprise demonstrates the manifold problems and their solution at the completion of a contract for disposal. By means of real measurement results for the emission situation the requirements of the environment protection, the approval process according to the German law and the experiences from the operation of the plant are explained. A special attention is drawn to the engineering solution as well as the measuring technique in context with the emission control. Finally, a view is given to the actual problems of the disposal of illuminating and signalling ammunition.
Author
Environment Protection; Pyrotechnics; Waste Disposal; Recycling; Pollution Control

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ENGINEERING (GENERAL)

19990053143 Research and Technology Organization, Applied Vehicle Technology Panel, Neuilly-sur-Seine, France
FLUID DYNAMICS PROBLEMS OF VEHICLES OPERATING NEAR OR IN THE AIR-SEA INTERFACE *[PROBLEMES DE DYNAMIQUE DES FLUIDES DES VEHICULES EVOLUANT DANS OU PRES DE L'INTERFACE AIR-MER]*
Fluid Dynamics Problems of Vehicles Operating Near or in the Air-Sea Interface; February 1999; 380p; In English; 5-8 Oct. 1998, Amsterdam, Netherlands; Sponsored by Research and Technology Organization, France; See also 19990053144 through 19990053173; Original contains color illustrations
Report No.(s): RTO-MP-15; AC/323(AVT)TP/9; ISBN 92-837-0004-X; Copyright Waived; Avail: CASI; A17, Hardcopy; A03, Microfiche

The papers prepared for the RTO Applied Vehicle Technology (AVT) Symposium on 'Fluid Dynamics Problems of Vehicles Operating Near or in the Air-Sea Interface' which was held 5-8 October 1998 in Amsterdam, The Netherlands, are contained in this report. In addition, a Technical Evaluator's Report aimed at assessing the success of the Symposium in meeting its objectives, and an edited transcript of the General Discussion held at the end of the Symposium are also included. In addition to presentations from the NATO Countries, this Symposium included several presentations by Russian and Ukrainian authors. In total, 30 papers were presented during sessions on the following subjects: (1) Aerodynamics and Flight Dynamics around Ships; (2) Stabilization and Control Techniques for Ships; and (3) Non-Classical Aircraft Flying Near the Air-Sea Interface.
Author
Fluid Dynamics; Aerodynamics; Ships; Air Water Interactions; Conferences

19990053158 Delegation Generale de l'Armement, Saint-Cloud, France
NEW ADVANCES IN SAILING HYDROFOILS
Lefaudeux, Francois, Delegation Generale de l'Armement, France; Fluid Dynamics Problems of Vehicles Operating Near or in the Air-Sea Interface; February 1999, pp. 15-1 - 15-14; In English; See also 19990053143; Original contains color illustrations; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

Two sailing hydrofoils projects are currently in progress in France. The objective of the first one, Techniques Avancees, is to establish a new all categories world speed record (now belonging to

Yellow Pages Endeavour with more than 46 knots). The objective of the second, L'Hydroptere, is even more ambitious; it is a new record for the eastward crossing of the Atlantic Ocean. The two boats have been built and they sail regularly, a lot have been learn from those experiments and they are quite successful. Techniques Avancees holds the world speed record in its size category, L'Hydroptere sails regularly at 35-37 knots and it has been recorded at 39 knots. This paper presents, first, a brief history of hydrofoil sailing, starting with Monitor, a very successful project dating from the end of the fifties. After this introduction to hydrofoil sailing, it concentrates on the two main design advances which explain the success of those two ships. The first deals with the lateral stability of hydrofoils sailing ships which have to counter the strong lateral force and heeling moment due to the action of the wind on the sails. The second deals with the problem of the general longitudinal stability of an ocean-going first generation hydrofoil in strong seas: how to avoid the dangers of fast changes in the flow angle of incidence on the main foils with the risks of negative lift and subsequent 'hard landing'.
Author
Hydrofoils; Hydrofoil Craft; Hydroplanes (Vehicles); Ships; Structural Design; Gas Turbine Engines; Engine Design

20000020829 Research and Technology Organization, Applied Vehicle Technology Panel, Neuilly-sur-Seine, France
GAS TURBINE ENGINE COMBUSTION, EMISSIONS AND ALTERNATIVE FUELS *[LA COMBUSTION DANS LES TURBO-MOTEURS, LES EMISSIONS ET LES CARBURANTS DE REMPLACEMENT]*
June 1999; 608p; In English; In French; 12-16 Oct. 1998, Lisbon, Portugal; See also 20000020830 through 20000020875; Original contains color illustrations
Report No.(s): RTO-MP-14; AC/323(AVT)TP/10; ISBN 92-837-0009-0; Copyright Waived; Avail: CASI; A99, Hardcopy; A06, Microfiche

The symposium dealt with Gas Turbine Engine Combustion, Emissions, and Alternative Fuels. Forty-six papers and a Keynote Address elucidated the role of the combustion process as a crucial factor of engine performance and operability under various conditions including non-standard, new fuels, and environmental effects of civil and military interest. There were 12 Sessions covering the following topics (some in 2 sessions): Gas Turbines in Land, Sea and Air Applications, Low-Emission Combustors, Combustion Modelling, Optical Measurements, Emissions, Combustor Design, Ignition Processes, Active Combustion Control, and Alternative Fuels
Author
Gas Turbine Engines; Conferences; Combustion; Fuels; Exhaust Emission

20000037841 Hall (B.) Industries, Inc., Toronto, Ontario Canada
MINIATURE REMOTE EYE/EAR LAND VEHICLE
Hall, B., Hall (B.) Industries, Inc., Canada; Grodski, J. J., Defence and Civil Inst. of Environmental Medicine, Canada; Advances in Vehicle Systems Concepts and Integration; April 2000, pp. B23-1 - B23-8; In English; See also 20000037804; Copyright Waived; Avail: CASI; A02, Hardcopy

A miniature remote surveillance land vehicle was developed for experimental real-time video/audio data acquisition in air defence live-fire training. A mobile sensing platform was needed to acquire the video/audio data at a close proximity to the gunners, without breaching safety requirements. The platform was designed to be small, conforming to the need to transport it as a passenger luggage on a commercial airline. A commercially available ready-made largest 1/10 scale Radio Control (R/C) hobby vehicle with 4 wheel drive system was chosen as the platform. It incorporated pre-built drive, suspension and steering systems. The chassis was fitted with 4 kg payload for a total weight of 8 kg. It was very stable after adding damping shocks and extending the chassis. It was capable of climbing 15 cm sidewalk curbs, driving down off 20 cm ledges, climbing 10 to 20 deg. slopes and through about 10 cm of light to medium snow with its original rubber tires. Its total travel range was shown to be over 800 m. The control function for the vehicle and its sensing system was achieved using an R/C unit whereby a channel-select plus channel signal multiplexing system was developed to operate one selected channel of 7 possible at a time using only two radio channels. The sensing capability of the vehicle involved a digital video/audio recorder positioned at the front of the platform and a miniature camera and microphone assembly placed on the top of a telescoping mast with an ultralight pan-tilt unit based on a micro R/C servos. The video and audio signals from the mast-mounted package were transmitted to the control station using a repackaged commercial transmitter. Testing and use of the vehicle determined operational limits of its performance and led to its modifications and enhancements.
Author
Air Defense; Test Firing; Surveillance; Remote Control; Audio Equipment; Video Data; Miniaturization

20000039703 Research and Technology Organization, Applied Vehicle Technology Panel, Neuilly-sur-Seine, France
MEASUREMENT TECHNIQUES FOR HIGH ENTHALPY AND PLASMA FLOWS *[TECHNIQUES DE MESURE POUR LES ECOULEMENTS DE PLASMA ET LES ECOULEMENTS A HAUTE ENTHALPIE]*
Measurement Techniques for High Enthalpy and Plasma Flows; April 2000; 401p; In English; 25-29 Oct. 1999, Rhode-Saint-Genese, Belgium; See also 20000039704 through 20000039719; CD-ROM contains full text document in PDF format; Original contains color illustrations
Report No.(s): RTO-EN-8; AC/323(AVT)TP/23; ISBN 92-837-1030-4; Copyright Waived; Avail: CASI; A18, Hardcopy; A04, Microfiche; C01, CD-ROM

The RTO AVT/VKI Special Course on 'Measurement Techniques for High Enthalpy and Plasma Flows' gathered specialists in this area from Europe, USA and Russia who combined their efforts to produce this comprehensive set of notes. The following topics were covered: (1) review of various high enthalpy and plasma flow facilities, (2) intrusive and non intrusive measurement techniques for the characterization of the flows generated in these facilities, and (3) utilization of the plasma facilities for the evaluation of material catalytic properties. The material assembled in this report was prepared under the combined sponsorship of the RTO AVT panel, the Consultant and Exchange Program of RTO and the von Karman Institute (VKI) for Fluid Dynamics.
Author
Procedures; Enthalpy; Plasmas (Physics); Magnetohydrodynamic Flow

20000047271 Research and Technology Organization, Studies, Analysis and Simulation Panel, Neuilly-sur-Seine, France
THE STORAGE OF POL AND CHEMICALS IN PACKAGING IN THE ROYAL NETHERLANDS ARMY
Approaches to the Implementation of Environment Pollution Prevention Technologies at Military Bases; April 2000, pp. 9-1 - 9-14; In English; See also 20000047263; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

In the nineteen eighties a chemical storage facility of Sandoz inc. in Basel suffered a major fire. During this disaster tons of toxic chemicals polluted the river Rhine severely. As a direct result of this disaster, the Netherlands Government introduced new environmental legislation on the storage of Petroleum, Oils, and Lubricants (POL) and chemicals in packaging. This legislation makes a distinction between a facility with a storage capacity of no more than 10 tons of POL and chemicals in packaging (Regulation CPR 15-1) and a facility with a storage capacity of more than 10 tons of POL and chemicals in packaging (Regulation CPR 15-2). If a major accident happens in a CPR 15-2 facility far more than 10 tons of chemicals are involved. As a consequence, requirements for a CPR 15-2 storage facility are much more severe than the requirements for a CPR 15-1 storage facility. Therefore, a CPR 15-2 storage facility is far more expensive. During the Sandoz-fire, all kinds of chemicals reacted in a uncontrolled way with each other. This caused additional risk to the environment. In order to prevent this happening in the future, both CPR 15-1 and CPR 15-2 regulations require the separate storage of chemicals, which can react dangerously with each other. In 1991 the Royal Netherlands Army introduced Environmental Care. As part of this scheme, several storage facilities for POL and chemicals were checked against these new regulations. The findings were: (a) Chemicals which can react dangerously with each other, were not stored in separate compartments, as required by both CPR 15-I and CPR 15-2 regulations; The average soldier had no idea, which chemical has to be separated from which; (b) There was no confidence in the logistics. Besides, every unit within the Army was licensed to order goods from the central Army-depots. As a result, every user within the Army had ample stores of POL and

chemicals. At one barracks stores sufficient for one and three quarter years of maintenance were discovered; (c) The storage facilities didn't meet the new requirements as formulated in CPR 15-1 or CPR 15-2; (d) As a consequence of the high level of stock, many Army barracks required a new storage facility accordingly to CPR 15-2; (4) The Commander in chief of the Army ordered an efficient and cost-effective solution for all the above problems.
Derived from text
Environment Protection; Pollution; Regulations; Stockpiling; Military Operations; Netherlands; Hazardous Materials

20000061422 Air Force Research Lab., Wright-Patterson AFB, OH USA
THE MULTIDISCIPLINARY ENGINEER IN THE CONTEXT OF CONCURRENT ENGINEERING
Moorhouse, David J., Air Force Research Lab., USA; Aerodynamic Design and Optimisation of Flight Vehicles in a Concurrent Multi-Disciplinary Environment; June 2000, pp. 3-1 - 3-7; In English; See also 20000061419; Copyright Waived; Avail: CASI; A02, Hardcopy

Throughout the evolution of the design of flight vehicles, the role of the individual engineer has also evolved. As aircraft have become more complex and performance envelopes have become ever larger, the role of the technical specialist has diminished in favor of the design team approach. Although the theme of the symposium deals with aerodynamic design and optimization, many comments apply to all technical disciplines. In this paper we review this design evolution very briefly. It is suggested that the evolutionary design process led to independent technical disciplines, technology development along the same lines and finally engineering education in the same engineering sciences. Concurrent engineering is discussed, together with the advantages and disadvantages from the viewpoint of the practicing engineers. It is suggested that the required approach leads to a requirement for engineers with a broader view than the traditional specialists. Next we consider the education process which, for design engineers, has evolved from apprenticeship to curricula that teach the engineering sciences. It is suggested that we may need to consider moving to the science of engineering. Finally, a possible view of future aerospace vehicle design is presented.
Author
Aerodynamics; Concurrent Engineering; Engineers; Transfer Of Training; Design Analysis

20000119918 Research and Technology Organization, Applied Vehicle Technology Panel, Neuilly-sur-Seine, France
DESIGN FOR LOW COST OPERATION AND SUPPORT *[LA CONCEPTION EN VUE D'UNE EXPLOITATION ET D'UN SOUTIEN A COUT REDUIT]*
September 2000; 161p; In English; In French; 21-22 Oct. 1999, Ottawa, Canada; See also 20000119919 through 20000119934; The CD-ROM contains full text document in PDF format
Report No.(s): RTO-MP-37; AC/323(AVT)TP/16; ISBN 92-837-0012-0; Copyright Waived; Avail: CASI; A08, Hardcopy; A02, Microfiche; C01, CD-ROM

The Specialists' Meeting discussed the Life Cycle Costs (LCC) of all military equipment and the applicability of LCC models developed for existing and future systems. There were four sessions covering the following topics: Introduction to Operation and Support Costs; Life Cycle Cost Modelling; Applications of Cost Modelling; and Techniques for Reduced Logistic Support Costs.
Author
Conferences; Papers; Life Cycle Costs; Low Cost; Operating Costs

20000119919 Belgian Air Force, Transport Aircraft and Helicopters, Brussels, Belgium
LIFE CYCLE COST: AN INTRODUCTION
Husniaux, A., Belgian Air Force, Belgium; Design for Low Cost Operation and Support; September 2000, pp. 1-1 - 1-7; In English; See also 20000119918; Copyright Waived; Avail: CASI; A02, Hardcopy

'Life Cycle Cost' (LCC) calculations, which give the global cost for the complete life cycle of a system, are becoming most common in the aeronautical field. Due to the actual budgetary context, characterized by stringent budget reductions, LCC is becoming a design parameter, having the same importance as the operational performance of the considered systems. Cost-effectiveness analyses, combined analyses of total cost and operational effectiveness, are now often an integral part of the decision cycle, starting with the expression of an operational need and ending with a procurement order of the production aircraft. Recent examples are the American Joint Strike Fighter (JSF) and the European Future Transport Aircraft (FTA). LCC models are very well suited to make cost-effectiveness analyses. They generate the necessary data for the planning cycle, give a clear insight in the expense flows and guarantee a transparent cost structure. There are a lot of different LCC models available. Some of them are predictive models, allowing weighing different design alternatives against each other. Others are models, allowing calculating the LCC of existing systems based on statistical exploitation data. The experience of the Belgian Air Force using life cycle cost models is illustrated with two examples. These examples demonstrate that life cycle costing is a strong instrument assisting the logistic support manager, both on existing weapon systems and on weapon systems still to develop.
Derived from text
Life Cycle Costs; Cost Analysis; Design To Cost; Cost Effectiveness

20000119921 Air Force Research Lab., Wright-Patterson AFB, OH USA
APPROACHES TO S AND T COST MODELING AT THE US AIR FORCE RESEARCH LABORATORY/VEHICLE AERONAUTICS DIRECTORATE
Quaglieri, Robert, Air Force Research Lab., USA; Blair, Max, Air Force Research Lab., USA; Design for Low Cost Operation and Support; September 2000, pp. 3-1 - 3-8; In English; See also 20000119918; Copyright Waived; Avail: CASI; A02, Hardcopy

The mission of the Air Force Research Laboratory (AFRL) is to lead the discovery, development, and transition of affordable, integrated technologies for our air and space forces -- to keep our Air Force 'the best in the world.' The Air Vehicles Directorate (AFRL/VA) is one of nine directorates within AFRL. VA develops and integrates fixed wing air vehicle technologies for the warfighter, and focuses resources to: (1) Demonstrate affordable and supportable options to improve capabilities in current fixed wing air vehicles and (2) Deliver revolutionary fixed wing air vehicle technologies for new warfighting capabilities.
Derived from text
Cost Analysis; Mathematical Models; Design To Cost; Life Cycle Costs; Cost Estimates; Production Costs

20000119922 Ministry of Defence, Paris, France
AN EXPERIENCE IN CONCURRENT RE-ENGINEERING OF WARSHIPS AND THEIR LOGISTICS, AS A USUAL BUSINESS *[UNE EXPERIENCE DE L'INGENIERIE CONCOURANTE DE NAVIRES DE GUERRE ET DE LEUR SOUTIEN LOGISTIQUE]*
Carillon, Jean-Philippe, Ministry of Defence, France; Design for Low Cost Operation and Support; September 2000, pp. 4-1 - 4-12; In French; See also 20000119918; Copyright Waived; Avail: CASI; A03, Hardcopy

A reform in the acquisition of weapon systems is currently in progress in some major countries. But the consequences are still to be derived in the domain of optimization studies. Really user friendly models to be used by participants in integrated program teams are still lacking. Moreover, as the frontiers between program stages fades away due to the need for continuous technological refreshments - among other reasons - and integrated program teams will have to support the product thru life, continuous re-engineering will arguably become a requirement for survival.
Derived from text
Concurrent Engineering; Design To Cost; Life Cycle Costs; Cost Analysis

20000119923 Defence Evaluation Research Agency, Centre for Defence Analysis, Farnborough, UK
RECENT COMBAT AIRCRAFT LIFE CYCLE COSTING DEVELOPMENTS WITHIN DERA
Woodford, Spencer, Defence Evaluation Research Agency, UK; Design for Low Cost Operation and Support; September 2000, pp. 5-1 - 5-12; In English; See also 20000119918; Copyright Waived; Avail: CASI; A03, Hardcopy

In an effort to permit the procurement of more cost-effective military equipment, several studies have been performed in collaboration with two leading UK Universities. This paper describes the rationale and requirements of both University programmes, and

gives details of the methods and some of the results generated. Rather than a broad overview of many different research activities within the Defence Evaluation and Research Agency (DERA), the purpose of this paper is to give as detailed a view as is possible of two recent studies, and the future developments that will stem from them. The first part of the paper describes a tool developed for the design and optimisation of combat aircraft for minimum Life Cycle Cost (LCC), whilst the second part explains the evolution and optimisation of a long-range ground-attack aircraft designed for minimum support. The LCC model excludes 'deep overheads', restricting the use of the models to the comparison of similar weapons systems (combat aircraft) with a common set of design objectives and performance constraints. The support estimation methodology of the second part makes use of known aircraft design variables to predict reliability and maintainability of the aircraft. Both research activities, and the subsequent development at DERA, should have a positive effect on the aircraft design process.
Author
Fighter Aircraft; Cost Effectiveness; Cost Estimates; Life Cycle Costs; Cost Analysis; Design To Cost; Production Costs

20000119925 Bombardier Aerospace, Downsview, Ontario Canada
DESIGN OPTIMIZATION USING LIFE CYCLE COST ANALYSIS FOR LOW OPERATING COSTS
Khan, Khalid A., Bombardier Aerospace, Canada; Houston, Graeme D., Bombardier Aerospace, Canada; Design for Low Cost Operation and Support; September 2000, pp. 8-1 - 8-8; In English; See also 20000119918; Copyright Waived; Avail: CASI; A02, Hardcopy

Life Cycle Cost Analysis is a powerful tool used to optimize the design for increase profitability and market share. It is a structured process that allows the user to collect and analyze all aspects of the design and financial variables to realize a well-balanced product. In Aerospace industry, Life Cycle Costing is becoming increasingly important since airlines are no longer willing to pay for inefficient design and high operating costs. Engineering can play a major role in increasing profit through LCC analysis. At the conceptual design stage, this type of study can be used to select a most LCC efficient configuration. That is lowest Bill of Material for the best economic value.
Derived from text
Cost Analysis; Cost Estimates; Life Cycle Costs; Low Cost; Operating Costs; Design To Cost

20000119930 DaimlerChrysler Aerospace A.G., Military Aircraft Div., Munich, Germany
AMPLIFICATION OF THE BENEFITS OF A RELIABLE AND MAINTAINABLE DESIGN BY ADEQUATE MAINTENANCE AND SUPPORT CONCEPTS
Reiss, Detlef, DaimlerChrysler Aerospace A.G., Germany; Design for Low Cost Operation and Support; September 2000, pp. 13-1 - 13-8; In English; See also 20000119918; Copyright Waived; Avail: CASI; A02, Hardcopy

The 2-level maintenance concept is characterized by: A reduction of the maintenance tasks to be performed at base-level, mainly on A/C and very limited off A/C tasks; and Transfer of the majority of off A/C maintenance and major scheduled maintenance to a single source supplier (industry). The 2-level maintenance concept offers significantly reduced Life Cycle Cost compared to the traditional 4-level maintenance concept if certain prerequisites are fulfilled. These prerequisites are: A reliable and maintainable design featuring low defect rates and long scheduled maintenance intervals; Availability of assets and tools required for maintenance at industry without additional cost; and An efficient support concept keeping the turn around times short. On the one hand, excellent Reliability and Maintainability are a prerequisite to make the 2-level maintenance a viable solution. On the other hand, a great potential for reduction of the Life Cycle Cost is not used if the advantages of a reliable and maintainable design are not amplified by the application of the 2-level maintenance concept.
Derived from text
Amplification; Reliability; Maintainability; Maintenance

20000119934 DaimlerChrysler Aerospace A.G., Military Aircraft Div., Munich, Germany
IDENTIFICATION OF LIFE CYCLE COST REDUCTIONS IN STRUCTURES WITH SELF-DIAGNOSTIC DEVICES
Brand, Clemens, DaimlerChrysler Aerospace A.G., Germany; Boller, Christian, DaimlerChrysler Aerospace A.G., Germany; Design for Low Cost Operation and Support; September 2000, pp. 17-1 - 17-8; In English; See also 20000119918; Copyright Waived; Avail: CASI; A02, Hardcopy

Life cycle cost (LCC) has become an essential parameter not just for accountants but also in engineering. It is not only the cost for product development or manufacturing which are the significant portions in aerospace applications but also those for maintenance, repair and maybe even disposal. Structures made of emerging materials such as carbon fiber reinforced plastics (CFRP) lead to new challenges for aircraft operators, one being the limited experience regarding maintenance and repair related LCC of these structures when compared to the experience gathered so far with metallic structures. Another big challenge is the increasing number and age of aircraft and the desire of military aircraft operators to keep fighter flight control systems as flexible as possible. This situation makes prediction of real service load spectra more and more difficult when compared to the situation in the past. The solution to this problem is increased monitoring in the 'advanced' age of aircraft which leads definitely to increased LCC. A way to reduce this LCC portion is automation, where various solutions for structural health monitoring have been proposed. These solutions include the integration of sensing devices into the structure in a way that non-destructive testing can become an integral part of the structural material. Within this paper an answer will be given to the question: How far can automation and thus self-diagnostic systems help to reduce LCC? This will be done by assembling maintenance data of different metallic and also composite components and deriving some cost estimating relationships (CER) before discussing potential LCC savings when integrating a self-diagnostic system. Most of the discussion will be made on the basis of the metallic components before predicting some possible LCC reductions with regard to CFRP components just entering their life cycle. Conclusions will finally be drawn with regard to future developments of structural health monitoring systems used for self-diagnosis of aircraft structures.
Derived from text
Life Cycle Costs; Cost Analysis; Cost Effectiveness; Design To Cost; Cost Estimates; Cost Reduction

20010016868 Research and Technology Organization, Human Factors and Medicine Panel, Neuilly-sur-Seine, France
THE HUMAN FACTOR IN SYSTEM RELIABILITY: IS HUMAN PERFORMANCE PREDICTABLE? *[LES FACTEURS HUMAINS ET LA FIABILITE DES SYSTEMES: LES PERFORMANCES HUMAINES, SOUT-ELLES PREVISIBLES?]*
January 2001; 110p; In English; 1-2 Dec. 1999, Siena, Italy; See also 20010016869 through 20010016875; Original contains color illustrations; CD-ROM contains full text document in PDF format
Report No.(s): RTO-MP-032; AC/323(HFM)TP/12; ISBN 92-837-1053-3; Copyright Waived; Avail: CASI; A06, Hardcopy; A02, Microfiche; C01, CD-ROM

Human error is seen as an unacceptably high contributing factor in most military accidents and much research has been carried out over the past 50 years, to attempt to predict the probability of the occurrence of human error. Significant advances have been made within the safety critical domain areas within the nuclear and chemical industries. The aim of the workshop was to review the research carried out across multiple domain areas in order to provide a clear focus for Working Group 30 (Human Reliability in Safety Critical Systems). It was evident from the workshop that key cognitive processes and organizational contexts play an important part in shaping the overall human performance and hence the likelihood of human error. Therefore it was clear that there are new approaches to Human Reliability Assessment that take account of the unique human adaptability attributes that are not present in any other part of the overall system in which the human is an integral part. Working Group 30 will develop these approaches to provide clear guidance to the NATO community in designing and analysing human roles to quantify and qualify the likelihood of error. This will enhance future design processes to produce higher fault tolerant designs, to include mitigating strategies and aim towards a significant reduction in the number of human errors.
Author
Human Performance; Reliability; Safety; Systems Analysis; Human Behavior; Conferences

20010016874 Leiden Univ., Centre for Safety Science, Netherlands
SAFETY CULTURE: THEORY AND PRACTICE
Hudson, Patrick, Leiden Univ., Netherlands; The Human Factor in System Reliability: Is Human Performance Predictable?; January 2001, pp. 8-1 - 8-12; In English; See also 20010016868; Copyright Waived; Avail: CASI; A03, Hardcopy

Safety Culture is seen as a way of ensuring high levels of safety performance in organizations, in contrast to the systematic engineered management of hazards and effects. This paper examines the notion of a safety culture in terms of the characteristics of being informed and trusting. These notions are related to more general organizational dimensions describing behaviors an attitudes. Cultures are seen as being defined by their Values, their Beliefs, their Common working Practices and also the ways in which they respond to unusual situations. In a Safety Culture these are all aligned to ensure safe operation even, or especially, when hazardous operations are undertaken. The evolutionary framework of cultures from the Pathological and the Reactive, through the Calculative or Bureaucratic to the Proactive and Generative cultures are described. The Generative culture is equated with the High Reliability Organizations identified in studies of military and civil high risk operations. Next a model is proposed for how to change organisations in order to acquire a safety culture. Finally the barriers to successful intervention are discussed. These include the nature of bureaucratic organisations, the conflicting goals of regulators, failures of management and the fact that change processes are hard.
Author
Safety; Safety Management; Management Systems; Social Factors

20010016875 Siena Univ., Multimedia Communications Lab., Italy
SHELFS: A PROACTIVE METHOD FOR MANAGING SAFETY ISSUES
Rizzo, A., Siena Univ., Italy; Save, L., Siena Univ., Italy; The Human Factor in System Reliability: Is Human Performance Predictable?; January 2001, pp. 9-1 - 9-9; In English; See also 20010016868; Original contains color illustrations; Copyright Waived; Avail: CASI; A02, Hardcopy

Safety knowledge is an important asset for managing safety critical organizations. In the paper we claim that reactive methods are not the more adequate approach to capture, represent, and reuse safety knowledge. The organizational model of accidents and the organizational learning processes ask for a different approach in analyzing and documenting safety issues. We present a proactive approach having a holistic view of the productive system, where all the system components and their interactions are analyzed. Examples drawn by an experimentation of the method are used to illustrate it.
Author
Safety; Safety Management; Computer Programs

20010019317 Research and Technology Organization, Information Systems Technology Panel, Neuilly-sur-Seine, France
COMMERCIAL OFF-THE-SHELF PRODUCTS IN DEFENCE APPLICATIONS 'THE RUTHLESS PURSUIT OF COTS' ***[L'UTILISATION DES PRODUITS VENDUS SUR ETAGERES DANS LES APPLICATIONS MILITAIRES DE DEFENSE 'L'EXPLOITATION SANS MERCI DES PRODUITS COMMERCIAUX']***
Commercial Off-the-Shelf Products in Defence Applications'The Ruthless Pursuit of COTS'; December 2000; 214p; In English; Commercial Off-the-Shelf Products in Defence Applications 'The Ruthless Pursuit of COTS'; 3-5 Apr. 2000, Brussels, Belgium; See also 20010019318 through 20010019341; CD-ROM contains full text document in PDF format
Report No.(s): RTO-MP-48; AC/323(IST)TP/7; ISBN 92-837-1049-5; Copyright Waived; Avail: CASI; A10, Hardcopy; A03, Microfiche; C01, CD-ROM

This volume contains 24 unlimited papers and 2 Keynote Addresses presented at the Information Systems Technology Panel Symposium held in Brussels, Belgium, 3-5 April 2000. The papers were presented under the following headings: (1) Academic Perspective: Commercial Off-the-Shelf Products (COTS) Acquisition, Utilization, and Evaluation; (2) COTS Acquisition Challenges; (3) COTS: Evaluation and Assurance; (4) Vendor Perspective: COTS; (5) User Perspective: COTS; and (6) COTS: Integration
Author
Conferences; Information Systems; Commercialization; Product Development

20010019320 Defence Evaluation Research Agency, Malvern, UK
STANDARDS: MYTHS, DELUSIONS AND OPPORTUNITIES
Peeling, Nic, Defence Evaluation Research Agency, UK; Taylor, Richard, Defence Evaluation Research Agency, UK; Commercial Off-the-Shelf Products in Defence Applications 'The Ruthless Pursuit of COTS'; December 2000, pp. 3-1 - 3-3; In English; See also 20010019317
Report No.(s): ISBN 92-837-1049-5; Copyright Waived; Avail: CASI; A01, Hardcopy

This paper describes how a new approach to defense standardization could deliver, for the first time, the benefits that defense standards and Open Systems have for so long promised. The paper traces the history of defense computing standards. It examines the original benefits that standardization promised in the defense arena. It examines why so many defense standardization efforts have failed to deliver on those promises. It then goes on to examine why the original efforts to create a standards-based computing market (the Open Systems movement) also failed. The limitations of a standards-based approach will be described from both a technical and commercial viewpoint. The paper concludes with an optimistic message, that the Internet Standards and the Open Source movement have the potential to deliver on the original promise of the Open Systems movement.
Author
Standardization; Computer Programs; Commercialization; Quality Control

20010019340 National Research Council of Canada, Inst. for Information Technology, Ottawa, Ontario Canada
MAINTAINING COTS-BASED SYSTEMS
Vigder, Mark R., National Research Council of Canada, Canada; Dean, John, National Research Council of Canada, Canada; Commercial Off-the-Shelf Products in Defence Applications 'The Ruthless Pursuit of COTS'; December 2000, pp. 12-1 - 12-6; In English; See also 20010019317
Report No.(s): ISBN 92-837-1049-5; Copyright Waived; Avail: CASI; A02, Hardcopy

After deployment, all software systems require an extensive and expensive phase of maintenance and management regardless of whether they are Commercial Off-the-Shelf (COTS)-based or custom built. Understanding how COTS-based systems are maintained, and why they are different from custom-built systems, can lead to systems that are better and more cost-effective over their lifetime.
Author
Computer Programs; Commercialization; Technology Utilization; Maintenance; Systems Management

20010081057 Research and Technology Organization, Applied Vehicle Technology Panel, Neuilly-sur-Seine, France
NATO EAST-WEST WORKSHOP ON MAGNETIC MATERIALS FOR POWER APPLICATIONS ***[ATELIER OTAN EST-OUEST SUR LES MATERIAUX MAGNETIQUES POUR APPLICATIONS PROPULSIVES]***
August 2001; 58p; In English; 25-30 Jun. 2000, Marathon, Greece; CD-ROM contains the entire document in PDF format
Report No.(s): RTO-TR-031; AC/323(AVT-060)TP/36; ISBN 92-837-1060-6; Copyright Waived; Avail: CASI; C01, CD-ROM; A04, Hardcopy; A01, Microfiche

The NATO Workshop with Partners for Peace on Advanced Magnetic Materials for More Electric Vehicles and Electric Pulse Power Weapons (AVT-060) was organised with the aim of assessing the need for improved magnetic materials primarily in future generations of more electric vehicles and (to a lesser extent) in electric pulse power weapons. Scientists from eight NATO countries and five non-NATO countries participated. Recent advancements and further improvements were discussed: 1) Applications; 2) Fundamental and Technical Magnetism; 3) Characterisation; 4) Materials; 5) Novel

Processing; and 6) foundations for future co-operation were established.
Author
Electric Motor Vehicles; Magnetic Materials; Magnetic Properties; Electric Power Supplies; Military Vehicles

20010082326 Research and Technology Organization, Systems Concepts and Integration Panel, Neuilly-sur-Seine, France
STRATEGIES TO MITIGATE OBSOLESCENCE IN DEFENSE SYSTEMS USING COMMERCIAL COMPONENTS *[STRATEGIES VISANT A ATTENUER L'OBSOLESCENCE DES SYSTEMES PAR L'EMPLOI DE COMPOSANTS DU COMMERCE]*
June 2001; 270p; In English; In French; 23-25 Oct. 2000, Budapest, Hungary; See also 20010082327 through 20010082355; Original contains color illustrations; CD-ROM contains full text document in PDF or PowerPoint format
Report No.(s): RTO-MP-072; AC/323(SCI-084)TP/31; ISBN 92-837-0020-1; Copyright Waived; Avail: CASI; A12, Hardcopy; C01, CD-ROM; A03, Microfiche

The meeting proceedings from this symposium on 'Strategies to Mitigate Obsolescence in Defense Systems Using Commercial Components' was organized and sponsored by the Systems Concepts and Integration (SCI) Panel of the Research and Technology Organization of NATO in Budapest, Hungary from 23 to 25 October 2000. The symposium's goal was to propose new strategies for obsolescence management including open architecture, functional partitioning and technology insertion that have to be addressed during system engineering, detailed design, production, and product support. The symposium outlined actual problems and solutions to the issue of obsolescence by the entire defense system community. It also addressed burning questions related to the problem of parts obsolescence and diminishing, manufacturing sources and material shortages. Management tools and methodologies to cope with the risk of obsolescence were discussed. This included new design concepts and system architectures to allow advanced technology insertion during the system life cycle. Session topics were organized under the four topics of: (1) status and experience with commercial off-the-shelf technology in defense electronic systems; (2) obsolescence management tools; (3) new design concepts and architectures to combat obsolescence; and (4) strategies and initiatives for life cycle management.
CASI
Commercial Off-The-Shelf Products; Conferences; Systems Engineering; Defense Industry; Avionics; Electronic Equipment; Computer Programs

20010082327 BAE Systems Avionics Ltd., Edinburgh, UK
TECHNICAL EVALUATION REPORT
Lynch, David, BAE Systems Avionics Ltd., UK; Strategies to Mitigate Obsolescence in Defense Systems Using Commercial Components; June 2001, pp. T-1 - T-8; In English; See also 20010082326; Copyright Waived; Avail: CASI; A02, Hardcopy

Since 1997 the Research and Technology Organisation (RTO) has been NATO's single focus for defense research and information interchange. The System and Concepts Integration (SCI) panel is one of six panels that cover the scientific and technical disciplines that bear upon defense issues. The SCI panel deals with advanced system concepts, integration, engineering techniques and technologies applicable to all platforms and operating environments, concentrating on mid to long term system level operational needs. During the period of operation of the RTO and the SCI panel, very significant changes have taken place in the area of defense procurement. The ever increasing cost of acquiring military hardware and software, together with major shifts in the electronics marketplace, prompted Defense Acquisition Reform in the USA as an attempt to leverage the defense dollar through utilization of commercial technology advances. The decision, prompted by the now famous 'Perry Memorandum' of 1994, to move towards performance based specifications led to the virtual abandonment of the MTL-STD and MIL-SPEC system that had underpinned military procurement for several decades. At the same time the market in semiconductors was increasingly being driven towards commercial telecommunications and computing needs, resulting in a reducing number of types and sources of military components. This effect has also been felt, although to a lesser extent, in the material supply and nonsemiconductor component markets. In combination these effects produce an ongoing obsolescence problem for legacy, or fielded, defense systems worldwide. The impact of Diminishing Manufacturing Sources and Material Shortages (DMSMS) can vary from the merely irritating to the showstopper. It is of grave concern to the NATO governments and the Defense and Aerospace industry, and the rate of discontinuance of part availability is steadily increasing. Many programs such as the F-22 stealth fighter, AWACS, Tornado, and Eurofighter are suffering from obsolescence. Concurrently with this increasing rate of military part obsolescence has come a progressive acceptance of the use of Commercial Off The Shelf (COTS) components, assemblies and systems in the defense arena. It is against this background that the SCI panel initiated this symposium.
Author
Defense Industry; Management Systems; Commercial Off-The-Shelf Products

20010082329 Teldix Luftfahrt-Ausruestungs G.m.b.H., Heidelberg, Germany
THE USE OF COMMERCIAL COMPONENTS IN DEFENSE EQUIPMENT TO MITIGATE OBSOLESCENCE: A CONTRADICTION IN ITSELF?
Petersen, Lutz, Teldix Luftfahrt-Ausruestungs G.m.b.H., Germany; Strategies to Mitigate Obsolescence in Defense Systems Using Commercial Components; June 2001, pp. 1-1 - 1-8; In English; See also 20010082326; Copyright Waived; Avail: CASI; A02, Hardcopy

The paper identifies and discusses the presently unresolved contradictions between the requirements of the national customers (MODs or Purchasing Agencies) and the viable options the industry can offer to mitigate the adverse effects of obsolescence for defense material with emphasis on the extended use of commercial off-the-shelf products.
Author
Commercial Off-The-Shelf Products; User Requirements; Technology Utilization

20010082330 Dy 4 Systems, Inc., Kanata, Ontario Canada
NEW APPROACHES TO PROCESSOR LIFECYCLE MANAGEMENT
Young, Duncan, Dy 4 Systems, Inc., Canada; Strategies to Mitigate Obsolescence in Defense Systems Using Commercial Components; June 2001, pp. 2-1 - 2-4; In English; See also 20010082326; Original contains color illustrations; Copyright Waived; Avail: CASI; A01, Hardcopy

There is a growing discontinuity between the semiconductor supply chain and the requirements of military programs to support equipment in the field for long periods of time - typically for 15 years or even longer. This isn't news any more, it was a natural consequence of the Commercial Off-the-Shelf Products (COTS) Procurement Initiatives and the shift in focus of the semiconductor supply industry, started early in the 1990s, to much larger and ever more lucrative markets. While COTS was embraced enthusiastically at the outset by our community, some of the real issues are only now beginning to come home to roost, tainting COTS as a standard for doing business. This is apparent through the performance of some suppliers, particularly in their attitudes and commitment to obsolescence and real lifecycle management. This paper has been written from the perspective of a COTS, open architecture, board-level supplier and is intended to provide insight and guidance for the selection and management of a supplier when considering various options of overall system lifecycle management.
Author
Commercial Off-The-Shelf Products; Industries

20010082333 Naval Air Warfare Center, Aircraft Div., Lakehurst, NJ USA
RISK-BASED COTS SYSTEMS ENGINEERING ASSESSMENT MODEL: A SYSTEMS ENGINEERING MANAGEMENT TOOL AND ASSESSMENT METHODOLOGY TO COPE WITH THE RISK OF COMMERCIAL OFF-THE-SHELF (COTS) TECHNOLOGY INSERTION DURING THE SYSTEM LIFE CYCLE
Lebron, Ruben A., Jr., Naval Air Warfare Center, USA; Rossi, Robert, Naval Air Warfare Center, USA; Foor, William, Naval Air Warfare Center, USA; Strategies to Mitigate Obsolescence in Defense Systems Using Commercial Components; June 2001, pp. 7-1 - 7-12; In English; See also 20010082326; Copyright Waived; Avail: CASI; A03, Hardcopy

Due to the rising costs of today's weapon systems, the US

Department of Defense (DOD) continues to implement strategies to reform its acquisition and procurement process. One such strategy seeks to reduce the cost of developing systems by purchasing commercial off-the-shelf (COTS) technology. The COTS technology ranges from components used to build a particular weapon system to functional pieces of gear used to support the weapon system, i.e., support equipment. The COTS technology may be instituted at the inception of the weapon system design or it may be inserted into the support of the weapon system at any point during its life cycle, The COTS technology is intended to reduce weapon system life-cycle costs by minimizing the expense of system design and testing.
Derived from text
Commercial Off-The-Shelf Products; Weapon Systems; Government Procurement

20010082337 Alenia Difesa, Graphic and Computing Dept., Pomezia, Italy
THE OBSOLESCENCE MANAGEMENT BASED ON A 'PRO-ACTIVE' APPROACH IN CONJUNCTION WITH A 'PRE-PLANNED' TECHNOLOGY INSERTION ROUTE
Buratti, Marco, Alenia Difesa, Italy; DelBrusco, Daniele, Alenia Difesa, Italy; Strategies to Mitigate Obsolescence in Defense Systems Using Commercial Components; June 2001, pp. 12-1 - 12-15; In English; See also 20010082326; Copyright Waived; Avail: CASI; A03, Hardcopy

Parts obsolescence was affecting all Alenia products/programs so that we had to identify a robust strategy to prevent uncontrolled effects. The design of products family has taken the obsolescence management issue as key basic requirement. The basic ideas on the back of our pro-active approach for obsolescence issues are: (1) All products (in terms of equipment, subsystem, or systems) design shall offers a flexible, open architecture which permits to change a specific functional block maintaining unchanged the overall architecture; (2) The open architecture used shall facilitate any design changes into the defined functional blocks (caused by obsolescence issues) because of the high level of interface standardization; (3) A product configuration for a pre-determined period of time shall be maintained by performing components buy for all expected production batches including logistic support, allowance, and spares; (4) There will be a defined periodic product enhancement which permit a pre-planned obsolescence removal activities and relevant design changes; (5) There will be an high level of backward compatibility between the updated system configuration and the previous one; (6) Technologies which support the product enhancement will be consolidated and introduced at a point where the level of risk is considered acceptable (or obsolescence became a major issue; (7) There will be a 'synchronized technology insertion route' defined in the frame of the Company strategies which takes into account customers' requirements and market trend; (8) The obsolescence removal activity can't be 'just in case' but needs to be anticipated and synchronized with a new technology insertion phase and or a step for a product enhancement; and (9) There is an absolute need for a company organization capable of provide continuous market survey so that any corrective action can be taken on time for a minor changes or a major synchronised product upgrade change.
Author
Standardization; Management Systems; Technology Utilization

20010082338 Thomson-CSF, Technologies et Methodes, Orsay, France
GENERIC TOOLS AND METHODS FOR OBSOLESCENCE CONTROL
Gaillat, Gerard, Thomson-CSF, France; Strategies to Mitigate Obsolescence in Defense Systems Using Commercial Components; June 2001, pp. 14-1 - 14-13; In English; See also 20010082326; Original contains color illustrations; Copyright Waived; Avail: CASI; A03, Hardcopy

The increasing discrepancy between the life cycles of professional electronics equipment and the life cycles of the components (which are largely intended for volume markets) means that professional electronics manufacturers must implement methods, processes, and tools to give their customers long-term availability guarantees for their products despite obsolescence problems in the components. Although this effort must be made at the level of each unit and adapted to the type of product, the customers' needs and internal organization, the existence of common methodological tools and principles can significantly help each unit set up the appropriate procedure for their particular case. This paper gives an overview of the methods and tools set up within the Thomson-CSF group to support the units in this procedure. These can be split into four levels, which correspond to increasing maturity of the obsolescence risk control: Level 1 is the curative level (during production and use phases); Level 2 is the downstream preventive level (also during production and use phases); Level 3 is the upstream preventive level (during development phase); and Level 4 is the upstream preventive level (during design phase). Finally, it asserts that controlling obsolescence and being able to guarantee the long-term availability of equipment is now a major part of the professional electronics manufacturer's job, and is an increasingly important factor in meeting customers' needs.
Author
Technology Utilization; Service Life; Systems Engineering

20010082341 Matra BAe Dynamics, Velizy-Villacoublay, France
SOC: A NEW APPROACH TO ENHANCE SYSTEM PERFORMANCES AND TO COMBAT THE LONG-TERM AVAILABILITY ISSUE *[SOC: UNE NOUVELLE APPROCHE DE L'AMELIORATION DES PERFORMANCES DES SYSTEMES POUR COMBATTRE LES PROBLEMES DE DISPONIBILITE A LONG TERME]*
Butel, P., Matra BAe Dynamics, France; Strategies to Mitigate Obsolescence in Defense Systems Using Commercial Components; June 2001, pp. 17-1 - 17-9; In French; See also 20010082326; Original contains color illustrations; Copyright Waived; Avail: CASI; A02, Hardcopy

Since military applications have lost their leadership in the field of electronics they will be used increasingly for civilian technologies, it will be necessary to learn how to use them or to adapt them to our specific needs, low production volumes, and high operating temperatures, for example. The use of what is customary to call 'off-the-shelf components' will continue even if the assurance of being able to supply them over the long term is a non-negligible factor. But another technology, which also comes from the civilian sector, seems to hold promise: the 'systems on a chip' or 'SoC.' In other words, the possibility of integrating a complete computer in a single circuit or a reduced number of circuits, that will satisfy, for example, the need for a piloting/guidance application for a missile. This approach is now well satisfied in the civilian and industrial world such as telecommunications, but still implemented to a rather small degree in defense systems.
Author
Systems-On-A-Chip; Military Technology; Technology Transfer

20010082346 Defence Evaluation Research Agency, Systems and Software Engineering Centre, Malvern, UK
PLANNING FOR CHANGE WITH A HOLISTIC VIEW OF THE SYSTEM
Dowling, Ted, Defence Evaluation Research Agency, UK; Strategies to Mitigate Obsolescence in Defense Systems Using Commercial Components; June 2001, pp. 22-1 - 22-8; In English; See also 20010082326; Copyright Waived; Avail: CASI; A02, Hardcopy

The example of obsolescence which perhaps comes most readily to mind is that of electronic components that are no longer available. However, this is just a special case of the more general form of obsolescence that arises when a system no longer provides an adequate solution to a user's problem. This may arise because the problem has changed or because the solution (the system) has, in some way. In practice, both the problem and solution are changing continuously and asynchronously. The approach to obsolescence management proposed here depends on recognizing and planning for this change. In essence, it involves looking forward to how the demands on the system and the technology that provides its capability may both change. Simulation is a crucial tool in doing this. In the light of the understanding of expected changes, the design of the current system is arranged to facilitate transition to the modified system and a change plan is produced. This paper also looks briefly at the impact of the proposed approach on the broader system engineering activities and the commitment it requires from the system's customer.
Author
Computerized Simulation; Systems Engineering; Replacing; Systems Management

20010082350 Stratum Management Ltd., Micheldever, UK
MANAGEMENT ISSUES IN THE USE OF COMMERCIAL COMPONENTS IN MILITARY SYSTEMS
Ellis, Richard, Stratum Management Ltd., UK; Strategies to Mitigate Obsolescence in Defense Systems Using Commercial Components; June 2001, pp. 26-1 - 26-10; In English; See also 20010082326; Copyright Waived; Avail: CASI; A02, Hardcopy

Commercial off the shelf (COTS) products are being used increasingly in military systems, an approach that offers many advantages including lower initial acquisition costs, faster delivery to the front line and ability to utilize the latest advances in technology - a seemingly perfect match to the 'faster, better, cheaper' ethos of modern acquisition initiatives. COTS products do, however, bring their own problems, including rapid obsolescence, lack of product control and fixed functionality optimized for the non-military market. In addition to addressing the complex technical issues that the use of COTS products brings, Defense Ministries and Industry will have to adapt their management approach and practices if the full potential of using commercial technology is to be realized, and dangerous pitfalls avoided. This paper discusses some of the management issues that will have to be addressed and draws a number of lessons relating to the avoidance of obsolescence problems during the in-service life of a system or platform.
Author
Commercial Off-The-Shelf Products; Defense Industry; Systems Management

20010082353 Defence Evaluation Research Agency, Whole Life Support Dept., Bromley, UK
FUTURE INITIATIVES FOR OBSOLESCENCE MITIGATION STRATEGIES
Smith, Ted, Defence Evaluation Research Agency, UK; Strategies to Mitigate Obsolescence in Defense Systems Using Commercial Components; June 2001, pp. 30-1 - 30-13; In English; See also 20010082326; Original contains color illustrations; Copyright Waived; Avail: CASI; A03, Hardcopy

The accelerating pace of technology change requires new approaches to the design, manufacture and through life support of military and long life cycle commercial platforms to minimize the effects of short-term technology obsolescence. The purpose of this paper is to describe medium and long-term strategies for the mitigation of obsolescence currently being considered in the UK. All complex military equipments are at risk from the effects of unmanaged technology obsolescence before and after they enter service. A systems engineering approach is described for the evolution of strategies that would involve co-operation between users and manufacturers to produce affordable through life solutions.
Author
Systems Engineering; Technology Utilization; Systems Management

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COMMUNICATIONS AND RADAR

19990026937 Research and Technology Organization, Research Study Group (RSG-19), Neuilly-sur-Seine, France
CODE OF BEST PRACTICE (COBP) ON THE ASSESSMENT OF C2 ***[CODE DE MEILLEURE PRATIQUE (COBP) POUR L'EVALUATION DU C2]***
March 1999; 152p; In English
Report No.(s): RTO-TR-9; AC/323(SAS)TP/4; ISBN 92-837-1055-X; Copyright Waived; Avail: CASI; A08, Hardcopy; A02, Microfiche; C01, CD-ROM; US Distribution and Sales Only

The Code of Best Practice (COBP) for Assessment of Command and Control (C2) offers guidance on the assessment of C2 (including C2 systems) for the purposes of supporting decision makers in acquisitions, operational assessments, and force planning. The Code is intended for use by experienced operational research analysts who are not necessarily experienced in C2 and its analysis, but have a general understanding of the C2 process. The Code describes the analytical tools and techniques, which allow the systematic study and evaluation of the contribution of C2 systems on the battlefield. Although its emphasis is on conventional land warfare, the Code was developed as robustly as possible and can be extended, with some additional effort, to a variety of other arenas. The organization of the Code follows the recommended C2 analysis methodology developed by the Research Study Group SAS-002. The methodology focuses on human and organizational factors, scenario specification and selection, measure of merit selection, tools, models, and their application. Recommendations for current best practice in conducting C2 analyses are summarized, and two examples are presented to illustrate the various techniques developed in the Code.
Author
Command And Control; Mathematical Models; Decision Making; Human Factors Engineering; Combat

19990054217 Research and Technology Organization, Information Systems Technology Panel, Neuilly-sur-Seine, France
FREQUENCY ASSIGNMENT, SHARING AND CONSERVATION IN SYSTEMS (AEROSPACE) ***[L'ATTRIBUTION, LE PARTAGE ET LA CONSERVATION DES FREQUENCES POUR LES SYSTEMES AERONAUTIQUES ET SPATIALES]***
Frequency Assignment, Sharing and Conservation in Systems (Aerospace); January 1999; 224p; In English; Information Systems Technology; 5-7 Oct. 1998, Aalborg, Denmark; See also 19990054218 through 19990054236; Original contains color illustrations
Report No.(s): RTO-MP-13; AC/323(IST)TP/1; ISBN 92-837-0003-1; Copyright Waived; Avail: CASI; A10, Hardcopy; A03, Microfiche

This volume contains the Technical Evaluation Report, the Keynote Address and the 18 unclassified papers, presented at the Information Systems Technology (IST) Panel Symposium held in Aalborg, Denmark from 5th to 7th October 1998, The papers presented covered the following headings: Spectrum Management and Use; and Emerging Technology and Criteria.
Author
Conferences; Information Systems; Frequency Assignment; Systems Management

19990054218 Defence Evaluation Research Agency, Malvern, UK
APPLICATION OF NEW TECHNIQUES TO MILITARY FREQUENCY ASSIGNMENT
Bradbeer, Ray, Defence Evaluation Research Agency, UK; Frequency Assignment, Sharing and Conservation in Systems (Aerospace); January 1999, pp. 1-1 - 1-6; In English; See also 19990054217; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

With increasing use of the RF spectrum, rapid and effective frequency assignment tools are an essential element in the maintenance of effective communications. An abstraction of the VHF Combat Radio Frequency Assignment problem is outlined and discussed in this paper. A key feature of this problem is the wide difference in the magnitude of the frequency separation constraints which arise as a result of radios being located in the same vehicle or site (cosited), and those which apply between nets which do not have cosited members. This feature is used to gain insight into the problem. It is inferred that, within the vast total solution space, it must be assumed that there are a great many optima or near optimal solutions. A proposed method using graph colouring together with a combinatorial algorithm is outlined. This uses the characteristic large differences between the constraints to focus the search on profitable areas of the solution space.
Author
Algorithms; Combinatorial Analysis; Frequency Assignment; Applications Programs (Computers)

19990054219 IIT Research Inst., Joint Spectrum Center, Annapolis, MD USA
SPECTRUM CERTIFICATION: THE FIRST STEP
Green, Stanley R., IIT Research Inst., USA; Scammon, Craig A., National Telecommunications and Information Administration, USA; Frequency Assignment, Sharing and Conservation in Systems (Aerospace); January 1999, pp. 2-1 - 2-10; In English; See also 19990054217; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

Assigning frequencies for electronic systems on the ever diminishing electromagnetic spectrum is a difficult process, compounded by the different modeling approaches that employ complex frequency assignment algorithms. These algorithms are based on the available equipment parameters and environmental data. The under-

lying assumption is that the data being used is the best and the most accurate data available. This assumption is rarely if ever correct. But with today's highly sophisticated technology in electronic equipment, having the most accurate data available for use in spectrum management systems such as the Joint Spectrum Management System for Windows (JSMS(sub W)) frequency assignment model is critical. Collecting accurate data begins with the request for spectrum allocation support, via the application for electronic equipment certification. This data collection continues through equipment design, procurement, and operational deployment of the electronic system. Traditionally, this collection of data began by entering the pertinent system data on a paper form. Today, a template for this form has been created, and the process for entering data has been automated by using the Spectrum Certification System (SCS). The National Telecommunications and Information Administration (NTIA) has been working on a new approach to capture the required data, using a Smart Interface Diagram (SID) technology. A computer software program called the Equipment Location - SID (EL_SID) that will automate the SID is under development. This program provides a graphical, icon-based user interface supported by sophisticated logic that captures inter- and intra system relationships and prompts the applicant to enter minimal but pertinent system parameters. The EL_SID interface will simplify the collection of data, enabling the applicant to enter the most comprehensive, and the most accurate, information available for particular operational characteristics of the electronic equipment. The EL_SID interface will also enhance earlier efforts at defining system characteristics by identifying the actual relationship between equipment parameters for the links in a network, and thus will provide the best available operating characteristics. This paper will describe the spectrum allocation process, provide a historical background of data entry, and look to the future for spectrum allocation and assignment.
Author
Spectra; Frequency Assignment; Electromagnetic Spectra; Data Acquisition; Computer Programs; Certification; Systems Management

19990054220 IIT Research Inst., Joint Spectrum Center, Annapolis, MD USA
SPECTRUM MANAGEMENT USING JSMS(SUB W)
Hensler, Thomas C., IIT Research Inst., USA; Frequency Assignment, Sharing and Conservation in Systems (Aerospace); January 1999, pp. 3-1 - 3-12; In English; See also 19990054217; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

The Joint Spectrum Management System for Windows (JSMS (sub W)) is a set of frequency management tools that runs on a personal computer. JSMS(sub W) provides the spectrum manager with the capability to create assignment proposals, edit them and perform validation checking of the proposal. The user then uses JSMS(sub W) to format the proposal for transmission to the US National Authority for approval. Other tools included are an interference reporting capability and an allotment plan generator which enables users to define the frequency resources for the frequency nomination capability. This paper focuses on the eight discrete steps performed during the JSMS(sub W) frequency nomination process. These steps are to: specify the parameters, select the environment records, create analysis records, cull environmental records not likely to interfere or to be subject to interference from the proposal, compute received interference power and system noise power levels, determine interference-free frequencies, and, then last, rank the proposed frequencies.
Author
Systems Management; Windows (Computer Programs); Spectra; Frequency Assignment

19990054221 Elmer, Rome, Italy
HF FREQUENCIES: SHARING AMONG NATO COUNTRIES
Proia, M., Elmer, Italy; Maviglia, G., Elmer, Italy; Frequency Assignment, Sharing and Conservation in Systems (Aerospace); January 1999, pp. 4-1 - 4-10; In English; See also 19990054217; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

In this paper, an efficient use of HF frequencies (2MHz to 30MHz) is investigated to establish radiocommunication between moving platforms operating in a given area and ground-based fixed stations suitably located to provide effective coverage of the area. In the first part of this paper, the use of the HF spectrum (2MHz to 30MHz) as a primary communication resource is justified, taking into consideration that the constraints associated with ionospheric propagation and spectrum congestion require efficient use of the available frequencies. These constraints may produce degradation in the skyway links. Considering the problem of communication between mobile units and ground-fixed stations in a NATO environment, the following part of the paper contains a description of the basic concepts followed by the ELMER engineering activity in the development of an HF radio communication system intended to allow any mobile unit to establish a link with at least one ground station within a predefined pool. This is achieved through mapping of the communication area by ground stations suitably located, combined with an efficient frequency management. An application is described in which the system concept is validated of the Mediterranean area. It should be understood, however, that the results of the investigation can be validated for any other area, with some modifications, if any.
Author
High Frequencies; Telecommunication; Radio Communication; Product Development; Communication Equipment

19990054222 ATDI Ltd., Crawley, UK
OPTIMISATION OF THE RADIO SPECTRUM: THE ROLE OF COMPUTER RADIO PREDICTION PACKAGES
Graham, Adrian, ATDI Ltd., UK; Frequency Assignment, Sharing and Conservation in Systems (Aerospace); January 1999, pp. 5-1 - 5-10; In English; See also 19990054217; Original contains color illustrations; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

It is recognized that a useful measurement factor in the assessment of spectrum management effectiveness is the number of users per square kilometre per MHz. Given that there is a requirement to maximize this factor, this paper examines computerized methods currently available to assist in the optimisation of spectrum usage. A methodology to extend this technology towards a more critically engineered solution is then examined.
Author
Optimization; Radio Spectra; Technology Assessment

19990054223 London Univ., Centre for Discrete and Applied Mathematics, UK
REAL-VALUED FREQUENCY ASSIGNMENT
FonDerFlaass, D. G., London Univ., UK; Frequency Assignment, Sharing and Conservation in Systems (Aerospace); January 1999, pp. 6-1 - 6-4; In English; See also 19990054217; Copyright Waived; Avail: CASI; A01, Hardcopy; A03, Microfiche

We consider the binary constraints formulation of the frequency assignment problem in its most general form: for an arbitrary metric space, with frequencies taking arbitrary real values, and with possibly infinitely many constraints. We obtain some necessary and sufficient conditions for the problem to have a solution with a finite span. When the metric space is the set of integers, we give an exact criterion. Also we demonstrate a connection of this problem in one-dimensional case with one combinatorial question about finite permutations; and pose some unsolved problems.
Author
Frequency Assignment; Combinatorial Analysis; Communication Networks

19990054224 GEC-Marconi Research Centre, Great Baddow, UK
HF FREQUENCY MANAGEMENT: PREDICTION AND ASSIGNMENT TOOLS FOR LARGE NETWORKS
Wheadon, N. S., GEC-Marconi Research Centre, UK; Frequency Assignment, Sharing and Conservation in Systems (Aerospace); January 1999, pp. 7-1 - 7-10; In English; See also 19990054217; Original contains color illustrations; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

With the advent of automatic and adaptive radio communications systems there has been a resurgence of activity in propagation at HF. The development of Automatic Link Establishment (ALE) and Automatic Link Maintenance (ALM) systems suggested the demise for HF prediction programs. These new systems would not need experienced operators and the systems would perform all the necessary frequency management tasks themselves. ALE and ALM have gone some way in optimizing the operation of systems on air; however in order to optimize the use of the HF spectrum, a planning exercise is still required which will provide a reasonable first selection of frequencies. For example, allocating the high end of the band

for short range near-vertical incidence skywave operations in winter at midnight would not necessarily be a sensible choice. This 'first cut' planning exercise could be performed using radios which contain simple software planning tools but coordination between separated users wishing to communicate becomes an issue. Alternatively the planning exercise can be performed using more sophisticated assignment tools located at a strategic centre or at a tactical command post. This paper describes two tools which can be used to perform tasks from the simple estimation of usable frequencies to more complex frequency allocation for large networks.
Author
Telecommunication; Frequency Assignment; Radio Communication; Communication Networks

19990054225 Thomson-CSF Airsys, Bagneux, France
LOW FREQUENCY RADARS: COMPATIBILITY WITH OTHER ELECTROMAGNETIC MEANS *[RADARS BASSE FREQUENCE: COMPATIBILITE AVEC LES AUTRES MOYENS ELECTROMAGNETIQUES]*
Zolesio, J. L., Thomson-CSF Airsys, France; Olivier, B., Thomson-CSF Airsys, France; Frequency Assignment, Sharing and Conservation in Systems (Aerospace); January 1999, pp. 8-1 - 8-4; In French; See also 19990054217; Copyright Waived; Avail: CASI; A01, Hardcopy; A03, Microfiche

The growth of military threats has led to the development of systems for detecting and evaluating threats. The capacities of these systems must continually be expanded even as economic constraints become ever more stringent. For surface systems, the current threat displays the following characteristics: (1) reduced SER (missiles, low-detectability and even stealth planes, etc.); (2) extended flight envelopes (from very low altitude for cruise missiles up to the zenith for ARM missiles); (3) increased flight dynamics which allow for use of natural field masks (helicopters an cruise missiles) and/or very high speeds; and (4) increased electronic countermeasure abilities with traditional interference and with signature masking by passive means (absorbers, adapted shapes) or active means.
Author
Low Altitude; Radar; Compatibility; Display Devices; Low Frequencies; Aircraft Detection

19990054226 Wales Univ. Inst. of Science and Technology, Dept. of Computer Science, Cardiff, UK
OPTIMIZING RADIO NETWORK DESIGN
Chapman, Simon J., Wales Univ. Inst. of Science and Technology, UK; Hurley, Steve, Wales Univ. Inst. of Science and Technology, UK; Kapp-Rawnsley, Rupert, Wales Univ. Inst. of Science and Technology, UK; Frequency Assignment, Sharing and Conservation in Systems (Aerospace); January 1999, pp. 9-1 - 9-12; In English; See also 19990054217; Original contains color illustraions
Contract(s)/Grant(s): ESPRIT Proj. 23243; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

Designing radio networks that utilize their allocated frequencies effectively and efficiently is a difficult problem. If a radio network is poorly designed then spectrum will be wasted and/or the quality of service will be degraded even if a good frequency assignment algorithm is used. To produce a well designed network the designer needs to take into account several competing factors. For example, cost may be reduced by having a few omni-directional antennas operating at full power, this may produce good area coverage and have a small amount of overlap between areas (and hence low interference). However, such a network may not be able to satisfy the traffic demands within the area assigned to each antenna i.e. its cell. To try and overcome this problem more antennas are required (perhaps using directional antennas at the same site or additional antennas at different sites). However this increases the cost, the potential for interference, and increases the difficulty of finding a good frequency assignment. For example, if the network design is used to generate channel separation constraints between pairs of transceivers then the required separations could have higher values on a poorly designed network relative to a well designed network. Consequently, frequency assignment algorithms e.g.,will find assignments which either use a larger range of frequencies than may be necessary (for minimum span assignment) or have a higher number of constraint violations in fixed spectrum problems. The radio network optimisation problem involves designing a radio network using an optimisation algorithm that takes into account competing factors. For example, the final network can be optimized for cost, interference, handover and traffic demands. Other constraints can be included as necessary.
Author
Optimization; Algorithms; Radio Communication; Frequency Assignment; Communication Networks

19990054227 North Atlantic Treaty Organization, Frequency Management Branch, Brussels, Belgium
THE IMPACT OF PROTECTION CRITERIA AND ASSIGNMENT ORDER ON MILITARY AIR GROUND AIR FREQUENCIES
Kho, K. S., North Atlantic Treaty Organization, Belgium; Elliot, M., North Atlantic Treaty Organization, Belgium; Frequency Assignment, Sharing and Conservation in Systems (Aerospace); January 1999, pp. 10-1 - 10-10; In English; See also 19990054217; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

Tactical air communications use the UHF 225-400 MHz military band in NATO Europe. Overall management of the military use of the band is performed by the NATO Frequency Management Sub-Committee (FMSC). The band is divided into allotments for each type of system e.g. Radio Relay (R/R), [Instrument Landing System (ILS),] UHF Satellite and Air-Ground-Air (A/G/A), based on an Allotment Plan agreed by the FMSC. The management of the A/G/A assignments is then performed centrally by the Frequency Management Branch (FMB) of the NATO HQ C3 Staff at NATO HQ, using a software tool called NATO UHF Frequency Assignment System (NUFAS 2). This paper first describes the assignment system of NUFAS 2 and then focuses on the results of an investigation into the impact of assignment order on the results of a bulk assignment process. Paragraphs 2 to 7 are background information for your convenience.
Author
Frequency Assignment; Radio Communication; Allocations

19990054228 Royal Holloway, Dept. of Computer Science, Egham, UK
ARE THERE EFFECTIVE BINARY FREQUENCY SEPARATION CONSTRAINTS FOR FREQUENCY ASSIGNMENT COVERAGE PROBLEMS?
Bater, Joe, Royal Holloway, UK; Jeavons, Peter, Royal Holloway, UK; Cohen, David, Royal Holloway, UK; Dunkin, Nick, Royal Holloway, UK; Frequency Assignment, Sharing and Conservation in Systems (Aerospace); January 1999, pp. 11-1 - 11-8; In English; See also 19990054217; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

Frequency assignment in cellular radio networks is often modelled using binary constraints between pairs of transmitters. These constraints restrict possible frequency channel assignments in order to reduce the risk of unacceptable interference. Here we question the adequacy of binary constraints of this kind to represent the problem effectively. In this paper we examine the use of binary constraints, based on predicted interference between pairs of cells, Having generated the binary constraints, they are solved using standard heuristic solution techniques, and tested back against the original system model. In many of the instances these solutions fail to provide complete coverage. By considering solutions calculated directly from the system model (i.e. a single global constraint), we obtain solutions to all problem instances which provide perfect predicted coverage. To achieve coverage in the binary model it is necessary to tighten the constraints in these instances by increasing the reference carrier-to interference thresholds at which constraints are enforced. This additional restriction forces the number of channels used in the solution to grow beyond that required of the global constraint solution. We conclude that representing the frequency assignment problem using binary constraints may be inadequate to capture the essential features of the problem, and that it may be necessary to include higher-order information in any effective model. Another conclusion concerns the lower bounds on the number of channels required that are sometimes calculated from a binary constraint model, using maximal cliques in the constraint graph, or other techniques. If the binary constraint model is not an adequate representation of the problem, then any such lower bound may be unreliable as an estimate of the spectral resources required for a cellular system.
Author
Frequency Assignment; Constraints; Carrier To Noise Ratios

19990054229 Universidad Carlos 3 de Madrid, Dept. Tecnologias de las Communicaciones, Madrid, Spain
EMERGING TECHNIQUES FOR DYNAMIC FREQUENCY ASSIGNMENT: MERGING GENETIC ALGORITHMS AND NEURAL NETWORKS
Bousono-Calzon, C., Universidad Carlos 3 de Madrid, Spain; Figueiras-Vidal, A. R., Universidad Carlos 3 de Madrid, Spain; Frequency Assignment, Sharing and Conservation in Systems (Aerospace); January 1999, pp. 12-1 - 12-6; In English; See also 19990054217; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

Genetic algorithms and neural networks have previously been applied to the hard problem of assigning channels in mobile communication systems. The interest in these algorithms is due to their generality and the possibility of fast hardware implementations that adapt to dynamical environments. Nevertheless, these algorithms perform differently: neural nets are known to better satisfy allocation constraints while genetic algorithms allow for global optimisation. We propose here to merge the best features of both algorithms in a quite natural manner. Simulations show that this merging has good performance, and suggest a new interesting direction for research. Author

Genetic Algorithms; Neural Nets; Mobile Communication Systems; Systems Simulation; Dynamical Systems; Frequency Assignment

19990054230 Diehl G.m.b.H. und Co., Roethenbach, Germany
ELECTROMAGNETIC COUPLING PATHS TO ELECTRONIC SYSTEMS CONNECTED WITH ELECTRONIC SETUPS AND DESTRUCTION MECHANISMS
Bohl, Juergen, Diehl G.m.b.H. und Co., Germany; Ehlen, Tilo, Diehl G.m.b.H. und Co., Germany; Sonnemann, Frank, Diehl G.m.b.H. und Co., Germany; Frequency Assignment, Sharing and Conservation in Systems (Aerospace); January 1999, pp. 13-1 - 13-6; In English; See also 19990054217; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

Within an investigation containing both measurements and intensive simulations an effective model creation for the examination of the coupling behaviour of HF interference and the coupling paths into electronic circuits is intended. Based on the predictions deriving from these results adequate hardening measures regarding functionality disturbances due to HF interference can be considered already in the development and design process. Electromagnetic field simulation programs are necessary for the analysis of the coupling effects into materials, the creation of signal amplifying body resonances and the coupling into power and signal wires. Network analysis programs are responsible for the detection of the HF-LF conversion at the electrical non-linearities and the computation of the radiation of the LF disturbance within the electronic circuit. The various electromagnetic interferences during the coupling process and the respective simulation programs are compared. A meaningful network analysis requires a coupling of these specific simulation tools. Author

Electromagnetic Coupling; Computerized Simulation; Electromagnetic Interference; Circuits

19990054231 British Telecom Research Labs., Intelligent Systems Research Group, Ipswich, UK
SOLVING THE RADIO LINK FREQUENCY ASSIGNMENT PROBLEM USING GUIDED LOCAL SEARCH
Voudouris, Christos, British Telecom Research Labs., UK; Tsang, Edward, Essex Univ., UK; Frequency Assignment, Sharing and Conservation in Systems (Aerospace); January 1999, pp. 14a-1 - 14a-12; In English; See also 19990054217; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

In this paper, we examine the application of the combinatorial optimisation technique of Guided Local Search to the Radio Link Frequency Assignment Problem (RLFAP). RLFAP stems from real world situations in military telecommunications and it is known to be an NP-hard problem. Guided Local Search is a metaheuristic that sits on top of local search procedures allowing them to escape from local minima. GLS is shown to be superior to other methods proposed in the literature for the problem, making it the best choice for solving RLFAPs. Author

Combinatorial Analysis; Frequency Assignment; Radio Frequencies; Optimization

19990054232 Essex Univ., Dept. of Computer Science, Colchester, UK
SOLVING THE RADIO LINK FREQUENCY ASSIGNMENT PROBLEM WITH THE GUIDED GENETIC ALGORITHM
Lau, T. L., Essex Univ., UK; Tsang, E. P. K., Essex Univ., UK; Frequency Assignment, Sharing and Conservation in Systems (Aerospace); January 1999, pp. 14b-1- 14b-28; In English; See also 19990054217; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

The Radio Link Requency Assignment Problem is an abstraction of a real life military application that involves the assigning of frequencies to radio links. This problem set consists of eleven instances that are classed as either a Constraint Satisfaction Optimization Problem or a Partial Constraint Satisfaction Problem. Each problem has different optimization and constraint requirements, and can have up to 916 variables, and up to 5548 constraints. The Guided Genetic Algorithm (GGA) is a hybrid of Genetic Algorithm and meta-heuristic search algorithm Guided Local Search. As the search progresses, GGA modifies both the fitness function and fitness template of candidate solutions based on feedback from constraints. In this paper we have shown that GGA has the best optimality-robustness advantage over current published results. Author

Frequency Assignment; Genetic Algorithms; Radio Frequencies; Optimization; Heuristic Methods

19990054233 Defence Evaluation Research Agency, Radio Science and Propagation Group, Malvern, UK
A DECISION AID TO PREDICT MONTHLY SIGNAL COVERAGE MAPS BETWEEN 30 AND 50 GHZ IN EUROPE
Shukla, Anil K., Defence Evaluation Research Agency, UK; Akram, Ammad, Defence Evaluation Research Agency, UK; Konefal, Tad, York Univ., UK; Watson, Peter, Bath Univ., UK; Frequency Assignment, Sharing and Conservation in Systems (Aerospace); January 1999, pp. 15-1 - 15-12; In English; See also 19990054217; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

The requirements of both commercial and military communications operators are towards increased data rates at long ranges to support applications such as the Integrated Digital Battlefield, High Definition Video Transmission (HDTV) and personnel communications for both micro and pico cell coverage. These requirements are forcing system designers and technology engineers to consider ever higher frequencies, such as millimetre wave frequencies (e.g., 20-40 GHz), where the spectrum is currently uncongested and where the necessary wide bandwidths may be available. As the number of commercial and military systems operating within this band increases, the pressure to optimize the packing density whilst minimising spectrum usage, interference and costs will also increase. To aid the effective design and deployment of triservice millimetre wave systems, a first generation MIllimetric Decision Aid System (MIDAS Version-1.0a) has been developed. This aid predicts monthly signal attenuations and availabilities between (initially) 30-50 GHz in the European environment. The tool may be used by system designers for hardware development optimisation, and by system planners to match communications tactics (e.g., platform altitude, range) to the battlespace environment to maximise the operational effectiveness of limited and costly communication assets. Author

Decision Support Systems; Digital Television; Superhigh Frequencies; Wave Generation; Millimeter Waves; High Definition Television; Frequency Assignment

19990054234 Thomson-CSF, Radars and Contre-Mesures, Elancourt, France
CONDITIONS FOR INSERTION OF WIDE-BAND RADARS
[CONDITIONS D'INSERTION DES RADARS A LARGE BANDE]
Isnard, Jean, Thomson-CSF, France; Frequency Assignment, Sharing and Conservation in Systems (Aerospace); January 1999, pp. 16-1 - 16-8; In French; See also 19990054217; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

The implementation of wide-band signals in radars results of the need to discriminate / classify targets, to resist countermeasures and to obtain precise maps of certain areas. Depending on the applications the signal waveforms and their spatial-temporal conditions of transmission will have to be harmonized among themselves and with those utilized by other applications; indeed it will become increasingly necessary to share at least partly the bandwidths for a

better use of the spectral resource. This paper outlines the internal and external conditions for the radio localisation service: the sharing of bandwidths between radars and other equipment in particular for radio communications should be possible provided that mutual constraints are accepted.
Author
Bandwidth; Radar; Broadband; Frequency Assignment; Frequency Control

19990054235 Thomson-CSF, Radars and Contre-Mesures, Elancourt, France
AIRBORNE METRIC FREQUENCY SURVEILLANCE RADAR (UHF-VHF)
Lacomme, P., Thomson-CSF, France; Carrara, B., Thomson-CSF, France; Frequency Assignment, Sharing and Conservation in Systems (Aerospace); January 1999, pp. 17-1 - 17-2; In English; See also 19990054217; Copyright Waived; Avail: CASI; A01, Hardcopy; A03, Microfiche

This paper presents a new concept of airborne surveillance system using a low frequency band (metrik wave length) aimed at: detecting and tracking air targets with low Radar Cross Section (RCS) such as stealth aircraft or missiles, and detecting and localizing moving and non-moving ground targets, possibly hidden under foliage.
Author
Airborne Surveillance Radar; Radar Cross Sections; Low Frequencies

19990054236 Oxford Univ., Mathematical Inst., Oxford, UK
A LINEAR PROGRAMMING APPROACH TO RADIO CHANNEL ASSIGNMENT IN HEAVILY LOADED, EVOLVING NETWORKS
Leese, Robert A., Oxford Univ., UK; Frequency Assignment, Sharing and Conservation in Systems (Aerospace); January 1999, pp. 18-1 - 18-10; In English; See also 19990054217; Sponsored in part by the UK Radiocommunications Agency under a contract with St. Catherines College, Oxford.; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

This paper investigates a possible approach to the radio channel assignment problem, based on linear programming relaxation, together with column generation. The method is tested on a set of benchmarks that are expected to be challenging, and most cases are handled well. Those that are not suggest possible improvements. The method becomes more attractive when there are multiple channel demands at each transmitter site. Attention is restricted to minimum span problems, with interference controlled by a constraint matrix, but similar approaches are possible for more general formulations.
Author
Linear Programming; Frequency Assignment; Network Analysis

20000004136 Research and Technology Organization, Systems Concepts and Integration Panel, Neuilly-sur-Seine, France
INTRODUCTION TO AIRBORNE EARLY WARNING RADAR FLIGHT TEST, VOLUME 16 ***[INTRODUCTION AUX ESSAIS EN VOL DES RADARS AEROPORTES D'ALERTE LOINTAINE], VOLUME 16***
Clifton, J. M., Editor, Research and Technology Organization, France; Lee, F. W., Editor, Research and Technology Organization, France; November 1999; 92p; In English
Report No.(s): RTO-AG-300-Vol-16; AC/323(SCI)TP/15-Vol-16; ISBN 92-837-1020-7; Copyright Waived; Avail: CASI; A05, Hardcopy; A01, Microfiche

During periods when military budgets and aircraft fleet sizes are shrinking, systems that serve to cost effectively increase the utility of the remaining weapons can still undergo procurement growth. The increased situational awareness and battle field management provided by Airborne Early Warning (AEW) radar is one such force multiplier. The primary role of an AEW aircraft is the long-range detection of airborne targets. As potent new airborne threats, such as low flying cruise missiles, reduce the timelines that traditional air defense systems have to react, the utility of an AEW system's long-range surveillance capabilities to recover the lost time is clear. Fundamentally, these new targets stress the principal performance capabilities of an AEW radar sensor leveling new requirements on these systems to deal with this advanced threat. These increased requirements have led to world-wide, substantive work in the development of radar upgrades to existing AEW aircraft, such as the U.S. Navy's E-2C Hawkeye and the U.S. Air Force's E-3A AWACS (Airborne Warning and Control Systems), as well as new systems and platforms, such as the Swedish Air Force's ERIEYE (Active Phased Array AEW Mission System). The required increases in sensitivity, resolution, and the associated data rates that stem from these performance improvements will have profound impact on the way these systems are operated and how they perform in various environments. As these increasingly capable systems evolve, AEW radar will be expected to take on additional missions and perform other surveillance functions in the pursuit of dominant battle field awareness. Unfortunately, little or nothing has been written to document the largely unique techniques needed to perform the system level flight testing of these new AEW radars. The procedures have largely been passed from one individual to the next without the benefit of substantive documentation. The purpose of this volume is to document the theory and procedures necessary to perform the developmental flight testing of the several major categories of AEW radar.
Author
Early Warning Systems; Flight Tests; Radar Detection; Airborne Equipment; Military Technology; Airborne Surveillance Radar; Awacs Aircraft

20000004555 Research and Technology Organization, Systems Concepts and Integration Panel, Neuilly-sur-Seine, France
APPLICATION OF MATHEMATICAL SIGNAL PROCESSING TECHNIQUES TO MISSION SYSTEMS ***[L'APPLICATION DES TECHNIQUES MATHEMATIQUES DU TRAITEMENT DU SIGNAL AUX SYSTEMES DE CONDUITE DES MISSIONS]***
November 1999; 118p; In English; 1-2 Nov. 1999, Cologne, Germany; 4-5 Nov. 1999, Paris, France; 9-10 Nov. 1999, Monterey, CA, USA; See also 20000004556 through 20000004561
Report No.(s): RTO-EN-7; AC/323(SCI)TP/16; ISBN 92-837-1021-5; Copyright Waived; Avail: CASI; A06, Hardcopy; A02, Microfiche

Presents a whole range of perspectives for different levels of mathematical signal processing, based on some of the most promising techniques. Particular attention is paid to the following subjects: Wavelet analysis: summary of the possibilities; application to detection in natural background radiation and extraction of primitive invariants. The concept of Multirate Filter Banks in conjunction with the various transforms which this technique enables; applications to compressed video image and sequence transmission, to noise rejection, to jamming and to encoding. Variational methods based on partial derivative equations for image processing and multi-scale video sequences; presentation of different image segmentation approaches; Multi-sensor processing based on the theory of evidence: processing of the functions of detection, classification, matching of ambiguous observations, or tracking, with the aim of solving problems such as data modelling, decision making, the management of non-uniform reference systems, or the integration of contextual knowledge.
Author
Signal Processing; Mathematical Models; Systems Integration; Multisensor Applications; Data Processing; Image Processing; Mission Planning

20000004556 Defence Evaluation Research Agency, Farnborough, UK
INTRODUCTION TO WAVELET ANALYSIS
Watson, G. H., Defence Evaluation Research Agency, UK; Application of Mathematical Signal Processing Techniques to Mission Systems; November 1999, pp. 1-1 - 1-12; In English; See also 20000004555; Copyright Waived; Avail: CASI; A03, Hardcopy; A02, Microfiche

This paper introduces the concepts of wavelet analysis and gives an overview of the numerous wavelet analysis techniques in existence. The principal aim of this paper is to promote an awareness of wavelet analysis, not to provide technical details, as the latter are available in many textbooks. Most of the underlying principles are applicable to 1-dimensional signal analysis, and there are straightforward methods to adapt 1D wavelet analysis to higher-dimensional data, also covered in this paper. Hence, much of this paper is concerned with 1-dimensional signal analysis, even though higher-dimensional data is of equal importance. Major topics covered in this paper are the continuous wavelet transform and its inverse, the discrete wavelet transform and its relation to multireso-

lution filter banks, orthonormal and biorthogonal wavelets, image wavelet analysis and wavelet packets.
Derived from text
Wavelet Analysis; Dimensional Analysis; Mathematical Models

20000004557 Defence Evaluation Research Agency, Farnborough, UK
THE DETECTION OF UNUSUAL EVENTS IN CLUTTERED NATURAL BACKGROUNDS
Watson, G. H., Defence Evaluation Research Agency, UK; Application of Mathematical Signal Processing Techniques to Mission Systems; November 1999, pp. 2-1 - 2-18; In English; See also 20000004555; Copyright Waived; Avail: CASI; A03, Hardcopy; A02, Microfiche

This paper is concerned with the use of wavelet analysis and statistical models of natural backgrounds as a means of detecting unusual events within, in particular targets of military interest. The underlying principle is to detect targets as objects that stand out from the background, and hence are unusual, rather than searching for objects with prescribed characteristics and dealing with clutter as an afterthought. First a method of feature extraction is described based on wavelet analysis which is used to characterize both backgrounds and unusual events. Then the statistics of these features for natural backgrounds are considered, making use of fractal geometry, from which basic clutter rejection can be implemented. More advanced clutter rejection methods are then considered, based on the multivariate statistics of additional measurements. Three cases are considered in detail: the wavelet analysis of multispectral data, the use of local variance to reject clutter in intermittent backgrounds, and the use of temporal variability to reject clutter in image sequences.
Author
Clutter; Wavelet Analysis; Mathematical Models; Multivariate Statistical Analysis; Two Dimensional Models; Image Classification

20000004558 Defence Evaluation Research Agency, Farnborough, UK
INVARIANT FEATURE EXTRACTION IN WAVELET SPACES
Watson, G. H., Defence Evaluation Research Agency, UK; Application of Mathematical Signal Processing Techniques to Mission Systems; November 1999, pp. 3-1 - 3-17; In English; See also 20000004555; Copyright Waived; Avail: CASI; A03, Hardcopy; A02, Microfiche

This paper is concerned with the extraction of geometric information from signals and images which is suitable for pattern recognition, but which is as insensitive as possible to the conditions of data collection, in particular sensor noise, background clutter and changes in the geometric relationship between the sensor and the scene (e.g. 3D viewing aspect). We describe a method of feature extraction which involves extending wavelet analysis beyond translation and dilation, leading to invariance to a greater variety of transformations, as well as insensitivity to noise and clutter. Feature extraction involves searching for local maxima in a generalisation of the continuous wavelet transform, and we describe how Riemannian geometry is used to aid this process. Additional topics covered are signal and image reconstruction, redundancy removal and application to 3D aspect-invariant target recognition. The analysis of any data, including signals and images, involves the extraction of application-specific information and the rejection of other less relevant data. Transforming the data into a form where the information of interest is easier to obtain often facilitates the analysis. Clearly, general-purpose transformations are more useful if they transform the data into a form of information that is relevant to many applications. This is the case with the Fourier transform because many phenomena of interest to scientists and engineers are more simply described in terms of sinusoids than the raw data samples. The wavelet transform is another example, which has become increasingly popular in recent years because of its ability to identify both position and scale, and hence the role it plays in multiresolution signal and image processing.
Derived from text
Wavelet Analysis; Image Resolution; Mathematical Models; Data Acquisition; Background Noise; Functions (Mathematics); Gauge Invariance

20000004559 Naval Air Warfare Center, China Lake, CA USA
MULTIRATE FILTER BANKS AND THEIR USE IN COMMUNICATIONS SYSTEMS
Creusere, Charles D., Naval Air Warfare Center, USA; Application of Mathematical Signal Processing Techniques to Mission Systems; November 1999, pp. 4-1 - 4-15; In English; See also 20000004555; Copyright Waived; Avail: CASI; A03, Hardcopy; A02, Microfiche

Multirate filter banks are the fundamental building blocks of efficient wavelet and waveletpacket implementations and are thus an important part of the current generation of image compression algorithms. In addition, multirate concepts also form the basis of local cosine transforms (LCTs) and lapped orthogonal transforms (LOTs) which are used in audio compression and noise removal applications. In this paper, we first discuss the fundamentals of multirate filter banks, both theory and implementation. Next, we focus on applications. In particular, we highlight wavelet-based image compression because research in this area has been very productive in recent years. We consider in particular embedded algorithms such as embedded zerotree wavelet (EZW) and set partitioning in hierarchical trees (SPIHT) because of the valuable capabilities they provide in a variety of military applications. Finally, we also discuss additional areas in which multirate filter banks play a roll including interference excision, signal scrambling, and code orthogonal frequency division multiplexing (COFDM) for data transmission.
Author
Telecommunication; Signal Processing; Cosine Series; Orthogonal Functions; Mathematical Models; Transformations (Mathematics); Wavelet Analysis

20000004560 Office National d'Etudes et de Recherches Aerospatiales, Paris, France
MULTISENSOR SIGNAL PROCESSING IN THE FRAMEWORK OF THE THEORY OF EVIDENCE
Appriou, Alain, Office National d'Etudes et de Recherches Aerospatiales, France; Application of Mathematical Signal Processing Techniques to Mission Systems; November 1999, pp. 5-1 - 5-31; In English; See also 20000004555; Copyright Waived; Avail: CASI; A03, Hardcopy; A02, Microfiche

In most of the requirements met in situation assessment, multisensor analysis has to be able to recognize in adverse conditions one situation out of a set of possibilities concerning for instance either localization, identity, or matching hypotheses, To do so, it uses measurements of more or less doubtful origin and prior knowledge that is understood to be often poorly defined, and whose validity is moreover difficult to evaluate under real observation conditions. The present synthesis proposes a generic modeling of this type of information in the framework of the theory of evidence, with closer attention being paid to the different natures of data processed in common cases. This modeling in then used to elaborate processing methods able to face specific problems that may arise when multisensor systems are implemented to achieve functions like detection, classification, matching of ambiguous observations, or tracking. Crucial practical problems are more specifically dealt with, such as appropriate combination processing and decision making, management of heterogeneous frames of discernment, and integration of contextual knowledge. Furthermore, the interest of a global functional approach at low level, possible in that framework, is emphasized.
Derived from text
Signal Processing; Knowledge Representation; Mathematical Models; Multisensor Applications

20000004561 Naval Air Warfare Center, China Lake, CA USA
PARTIAL DIFFERENTIAL EQUATIONS FOR MULTISCALE IMAGE AND VIDEO PROCESSING
Hewer, Gary, Naval Air Warfare Center, USA; Kenney, Charles, California Univ., USA; Application of Mathematical Signal Processing Techniques to Mission Systems; November 1999, pp. 6-1 - 6-13; In English; See also 20000004555
Contract(s)/Grant(s): N00014-96-1-0456; Copyright Waived; Avail: CASI; A03, Hardcopy; A02, Microfiche

Three PDE (Partial Differential Equation) image processing methods are discussed: Mumford-Shah variational methods, peer group averaging (PGA), and Osher-Rudin shock filtering. Each of these methods is used in segmenting images into homogeneous regions separated by distinct boundaries; reducing the image to regions and boundaries extracts the image structure in a way that

can be interpreted automatically by parsing algorithms. Mumford-Shah algorithms approach the problem of segmentation as one of approximation. The approximation to the image is represented by the homogenized regions and their boundaries. The best approximation is found by minimizing an objective function that controls 1) degree of approximation, 2) smoothness within regions and 3) extent of region boundaries. These three objectives are controlled by weight parameters; choosing these parameters correctly is a problem of major concern for Mumford-Shah algorithms. Once the parameters are selected the objective function can be minimized via an energy descent method resulting in a nonlinear PDE with the original image as initial data. Evolution under the PDE produces the desired approximation and image segmentation. Recent work by Hewer et al. has implemented this procedure in a manner that minimizes the parameter selection problem and greatly reduces the number of descent steps needed for an acceptable approximation. This reduction is due in part to the use of PGA as a preprocessing step: the initial image data is replaced by the PGA-filtered image. Since PGA produces results that are near the desired Mumford-Shah approximation only a few descent steps are required.
Author
Partial Differential Equations; Video Communication; Parsing Algorithms; Image Processing; Mathematical Models

20000011747 Army Aeromedical Research Lab., Fort Rucker, AL USA
ROTARY-WING CREW COMMUNICATION PATTERNS ACROSS WORKLOAD LEVELS
Katz, Lawrence C., Army Aeromedical Research Lab., USA; Fraser, E. Beth, Army Aeromedical Research Lab., USA; Wagner, Terry L., Army Aeromedical Research Lab., USA; Current Aeromedical Issues in Rotary Wing Operations; August 1999, pp. 14-1 - 14-3; In English; See also 20000011735; Copyright Waived; Avail: CASI; A01, Hardcopy; A03, Microfiche

Human error has been identified as the primary contributor to aircraft mishaps. A critical implication of this finding for the military rotary-wi'ng community is the need to objectively assess the coordinated behaviors of two-person aircrews. Specifically, there is a current, pressing need to gain an understanding of crew communication patterns and how those patterns are affected by the high stress, high workload environment inherent to this mileu. Two-person aircrews were presented with 402 single-engine emergencies while completing a total of 272 full-mission simulated flights at three Army posts. In addition, 11 aircrews completed a series of 10 simulated training missions requiring incrementally increasing overall workload. We used the Coordination Index Rating of Crew Linguistic Events (CIRCLE) system to analyze paired verbalizations reflecting crew coordination basic qualities across flight phases requiring varying workload levels. We developed a normative template of mean crew communication index workload levels, against which individual crews may be compared. The patterns of each of the crew coordination basic qualities across workload levels are presented. The template of crew communication patterns across workload levels developed in this study may be used to assess the effectiveness of crew communication training efforts in the future. Furthermore, this study demonstrated the ability of CIRCLE to address specific fluctuations in communication patterns, suggesting the potential utility of the system towards analysis of other factors affecting crew communication.
Author
Workloads (Psychophysiology); Flight Simulators; Human Factors Engineering; Communication; Rotary Wing Aircraft; Flight Crews

20000011765 Royal Norwegian Inst. of Aviation Medicine, Oslo, Norway
DOUBLE HEARING PROTECTION AND SPEECH INTELLIGIBILITY: ROOM FOR IMPROVEMENT
Wagstaff, Anthony S., Royal Norwegian Inst. of Aviation Medicine, Norway; Woxen, Ole J., Royal Norwegian Inst. of Aviation Medicine, Norway; Current Aeromedical Issues in Rotary Wing Operations; August 1999, pp. 33-1 - 33-5; In English; See also 20000011735; Copyright Waived; Avail: CASI; A01, Hardcopy; A03, Microfiche

Double hearing protection is used in many air forces around the world for protection in noisy aircraft environments, particularly in helicopters. The usual combination is foam ear plugs under headset or helmet muffs. Much of the research that spurred the introduction of foam earplugs indicated little change in speech intelligibility in persons with normal hearing. However, air crew often complain about having to maximize intercom volume for speech understanding, causing a situation with no reserve volume and bad sound quality. In recent years, further developments include so-called Hi-Fi plugs and custom made ear plugs which are claimed to improve speech communication. The aim of the present project was to investigate different types of ear plugs and their effect on speech intelligibility in helicopter noise. Each of nine normal-hearing pilot subjects were placed in an environment of recorded helicopter noise from a BO-105 helicopter. Speech audiometry was performed under four different conditions: Headset only and three different ear plugs worn under the headset. Fitting of the ear plugs was performed by an ear, nose and throat specialist to ensure similar conditions. The sequence of test conditions was randomised and double-blind. In addition, a subjective rating scale was used. Wearing foam ear plugs under the headset decreased speech intelligibility dramatically. The 'HiFi' plug was somewhat better than foam plugs, and the custom made ear plug provided a speech intelligibility close to the headset-only situation. Subjective rating scores coincided with these findings. In helicopter noise, custom made ear plugs may provide a much improved speech intelligibility over conventional foam ear plugs worn under the headset.
Author
Hearing; Ear Protectors; Aircraft Noise; Audiometry; Bo-105 Helicopter; Flight Crews; Intelligibility

20000011766 Army Aeromedical Research Lab., Fort Rucker, AL USA
AN INSERT HEARING PROTECTOR WITH VOICE COMMUNICATIONS CAPABILITY
Mozo, Ben T., Army Aeromedical Research Lab., USA; Gordon, Elmaree, Army Aeromedical Research Lab., USA; Murphy, Barbara A., Army Aeromedical Research Lab., USA; Current Aeromedical Issues in Rotary Wing Operations; August 1999, pp. 34-1 - 34-4; In English; See also 20000011735; Copyright Waived; Avail: CASI; A01, Hardcopy; A03, Microfiche

Helmets equipped with communications receivers contained within earcup enclosures have historically been the primary hearing protector and source of command input for aviators. There are inadequacies in this approach in terms of hearing protection and voice communications. The reduction of all noise levels reaching the ear to below 85 dBA, by using the helmet alone, is not attainable for all flight conditions in all U.S. Army helicopters. Earplugs worn in combination with the aviator's helmet do provide adequate protection from any Army noise environment, but sometimes at the expense of voice communications. Insert communication devices are a means of improving hearing protection while enhancing voice communications in noisy environments. Improving voice communications can improve overall performance, reduce stress, and increase situational awareness. Characteristics of insert communication devices being assessed in U.S. Army helicopters are discussed and compared with other means of enhancing hearing protection and communications. Development and fielding issues, along with results of field assessment of a large sample of the aviator population, are provided.
Author
Ear Protectors; Voice Communication; Aircraft Pilots; Aircraft Noise; Flight Clothing; Hearing; Flight Conditions

20000012198 Research and Technology Organization, Information Systems Technology Panel, Neuilly-sur-Seine, France
TACTICAL MOBILE COMMUNICATIONS *[COMMUNICATIONS TACTIQUES MOBILES]*
November 1999; 328p; In English; 14-16 Jun. 1999, Lillehammer, Norway; See also 20000012199 through 20000012232
Report No.(s): RTO-MP-26; AC/323(IST)TP/2; ISBN 92-837-1022-3; Copyright Waived; Avail: CASI; A15, Hardcopy; A03, Microfiche

This volume contains the Technical Evaluation Report and 35 unclassified papers, presented at the Information Systems Technology Panel Symposium held in Lillehammer, Norway from 14th to 16th June 1999. The papers were presented under the following headings: Personal Communications and COTS. Protocols and Networks. Propagation. Speech and Signal Processing. and High Frequency
Author
Conferences; High Frequencies; Information Systems; Mobile Communication Systems; Signal Processing

20000012199 Defence Evaluation Research Agency, Communications Dept., Defford, UK
EMERGING PERSONAL COMMUNICATIONS FOR MILITARY APPLICATIONS
Wells, Paul, Defence Evaluation Research Agency, UK; Thorlby, Paul, North Atlantic Treaty Organization, Netherlands; Tactical Mobile Communications; November 1999, pp. 1-1 - 1-9; In English; See also 20000012198; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

The technology revolution in mobile communications combined with the widening of military roles during the 1990's continues to present new opportunities for civil systems to be used by the military. The new global political context requires a military capability that can function in concept with other nations and respond rapidly to a wide variety of situations (ranging from humanitarian aid, through peace keeping and peace enforcement to coalition intervention). Many of this operations may occur 'out of area' (OOA). The response to this situation is exemplified in the creation of the UK Joint Rapid (JRRF), the ACE Rapid Reaction Corps (ARRC), and the NATO Combined Joint Task Force (CJTF) concept. These forces require flexible, deployable, scalable communications and information systems (CIS) often to areas where the indigenous infrastructure cannot be assumed. The significant new 'mobile communications' market sector is beginning to challenge the dominance of the fixed telecommunications infrastructure for the provision of services to the end user. This technology revolution is generally known as Personal Communications Services (PCS) and includes a number of system standards; terrestrial and satellite based. Most notably in the provision of public service is GSM (65% global digital market). The emerging TETRA system (digital trunked mobile radio) is of particular interest to low enforcement and paramilitary users since it offers feature features specifically required by that user community. This paper presents an overview of the major system standards (current and emerging) and discusses the potential for military use of each. PCS systems are the subject of ongoing study and test-bed activity by DERA (UK) and NC3A-NL.
Derived from text
Telecommunication; Mobile Communication Systems; Military Technology; Information Systems

20000012200 GEC-Marconi Research Centre, Chelmsford, UK
APPLICABILITY OF TETRA FOR USE AS A MILITARY TACTICAL RADIO
Dearlove, C. M., GEC-Marconi Research Centre, UK; Currie, J. C., GEC-Marconi Research Centre, UK; Taylor, D. J., Marconi Communication Systems Ltd., UK; Tactical Mobile Communications; November 1999, pp. 2-1 - 2-11; In English; See also 20000012198; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

The increasing need for military requirements to be met wherever possible by commercial off the shelf (COTS) equipment makes the use of modern civil mobile radio systems by the military of strong current interest. One system of particular note is TETRA (TErrestrial Trunked RAdio). This is a new digital Private Mobile Radio (PMR) system which has been standardized by the European Telecommunications Standards Institute (ETSI). TETRA has been designed to include the requirements of public safety users, and provides a number of features particularly suited for that purpose, some of which make the use of TETRA of particular interest for possible military use. This paper gives an outline of the TETRA system, and concludes that TETRA has a role to play in some military scenarios.
Author
Radio Communication; Communication Networks; Technology Transfer

20000012201 Defence Evaluation Research Agency, Communications Dept., Malvern, UK
SUPPORTING USER AND INFRASTRUCTURE MOBILITY IN THE TACTICAL ENVIRONMENT
Barfoot, Rick, Defence Evaluation Research Agency, UK; Daniell, Jason, Defence Evaluation Research Agency, UK; Tactical Mobile Communications; November 1999, pp. 3-1 - 3-7; In English; See also 20000012198; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

The military environment poses a challenge for the support of high levels of subscriber mobility. The requirement for an increasingly fluid infrastructure further compounds this problem. Additionally, these requirements have to be met by an infrastructure that is resilient to fault and loss, but constrained by limited link capacity. This paper indicates techniques that are being examined in Defence Evaluation and Research Agency's (DERA's) research programme to help overcome these issues. These ideas centre on the use of prediction techniques to position appropriate information for resilience and responsiveness, and then slowly adapt the location to the changing infrastructure.
Author
Prediction Analysis Techniques; Mobility; Procedures; Research

20000012202 National Defence Research Establishment, Linkoeping, Sweden
TACTICAL RADIO ACCESS NETWORKS BASED ON FUTURE CIVILIAN WIRELESS COMMUNICATION ARCHITECTURES
Nilsson, Jan, National Defence Research Establishment, Sweden; Englund, Eva, National Defence Research Establishment, Sweden; Groenkvist, Jimmi, National Defence Research Establishment, Sweden; Hansson, Anders, National Defence Research Establishment, Sweden; Skoeld, Mattias, National Defence Research Establishment, Sweden; Sterner, Ulf, National Defence Research Establishment, Sweden; Soederquist, Ingrid, National Defence Research Establishment, Sweden; nder, Jens, National Defence Research Establishment, Sweden; Tactical Mobile Communications; November 1999, pp. 4-1 - 4-8; In English; See also 20000012198; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

We investigate architectures where a tactical radio subsystem can integrate in civilian systems. The idea is that civilian communication infrastructure should be used wherever it is available. One such possibility may be found in the proposed next generation wireless communication system UMTS, where the definition of a Radio Network Subsystem (RNS), encapsulating all the features of wireless mobile communication has been proposed. We adopt this design paradigm to see if it is possible to find a low cost military network (by maximal use of civilian network technology and communication applications). The idea is to within the frame- work of an RNS, encapsulate also features specific to tactical wireless communications, a Tactical Radio Access Network (TRAN). Based on UMTS we describe two system concepts and architectures for designing a TRAN. Furthermore, a feasibility investigation of the concepts is conducted.
Author
Radio Communication; Radio Transmission; Technology Utilization; Technology Transfer

20000012203 Naval Research Lab., Information Technology Div., Washington, DC USA
ENERGY-EFFICIENT WIRELESS NETWORKING TECHNIQUES: FUNDAMENTAL ISSUES AND AN APPLICATION TO MULTICASTING IN AD HOC NETWORKS
Wieselthier, Jeffrey E., Naval Research Lab., USA; Nguyen, Gam D., Naval Research Lab., USA; Ephremides, Anthony, Maryland Univ., USA; Tactical Mobile Communications; November 1999, pp. 5-1 - 5-13; In English; See also 20000012198; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

Energy is a scarce resource in military ad hoc networks. In this paper we address the fundamental research issues associated with energy-efficient networking, and we apply energy-efficient networking techniques to the problem of multicasting. We discuss the impact of the wireless medium on the multicasting problem and the fundamental trade-offs that arise. We propose and evaluate several algorithms for defining multicast trees when transceiver resources are limited. The algorithms select the relay nodes and the corresponding transmission power levels, and achieve different degrees of scalability and performance. Our performance results demonstrate that the incorporation of energy considerations into multicast algorithms can, indeed, result in improved energy efficiency.
Author
Energy Conservation; Transmitter Receivers; Algorithms; Network Analysis

20000012204 Naval Research Lab., Washington, DC USA
EXTENDING THE LITTORAL BATTLESPACE (ELB): ADVANCED CONCEPT TECHNOLOGY DEMONSTRATION (ACTD)
Althouse, Edwin L., Naval Research Lab., USA; Tactical Mobile

Communications; November 1999, pp. 6-1 - 6-11; In English; See also 20000012198; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

This paper discusses the networking technology used to support a Department of Defense Advanced Concept Demonstration during April 1999 in support concepts of littoral operations and operational from the sea. Commercial wireless products were modified to support extension of the Navy shipboard data networks to inland, non-mechanized troops and to mobile command posts. Demonstrated computer applications included IVOX 'voice-over-data,' Cu-See-Me (for multi-window laptop conferencing), video teleconferencing to large sites, fire-support software, command-control software, and government- developed, wearable-computer software called InCON (TM) to display the common tactical picture down to the lowest echelons.

Author

Communication Networks; Computer Techniques; Computer Programs; Command And Control

20000012205 North Atlantic Treaty Organization, Communications Systems Div., The Hague, Netherlands

PCS STUDY PLAN

Young, N., North Atlantic Treaty Organization, Netherlands; Yavuz, D., North Atlantic Treaty Organization, Netherlands; Tactical Mobile Communications; November 1999, pp. 7-1 - 7-7; In English; See also 20000012198; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

The motivation of this paper are: (1) Traditional military comms requirements: security, mobility, flexibility, reliability, and alternatives. (2) Recent Trends in Military Comms: bringing of tactical & strategic comm requirements; integration of voice & data networks (the internet); move away from stove-piped single purpose systems toward multi-purpose IP networks; and move toward COTS solutions. (3) Attractive Features of PCS Technology: relatively low cost; interoperability potential with NATO and non-NATO organisations; some based on open standards with global availability; and earth coverage of satellite-based systems (ICO, GlobalStar, Iridium etc.)

CASI

Military Technology; User Requirements; Security; Mobility; Flexibility; Reliability

20000012206 Bundesamt fuer Wehrtechnik und Beschaffung, Tactical Mobile Networks Section, Koblenz, Germany

TACTICAL MOBILE COMMUNICATION USING CIVILIAN STANDARDS: A PRELIMINARY STUDY, 2000-2003

Mueller, Dirk, Bundesamt fuer Wehrtechnik und Beschaffung, Germany; Tactical Mobile Communications; November 1999, pp. 8-1 - 8-3; In English; See also 20000012198; Copyright Waived; Avail: CASI; A01, Hardcopy; A03, Microfiche

This paper describes a preliminary study that starts in 2000 ending in 2003. The task performed in this study is to evaluate the usability of civilian mobile communication networks for military purposes. Military add-ons needed to meet military requirements are to be identified. Technical prototype solutions will be implemented and evaluated in an experimental system. Finally, the results of this study will give advice for the procurement of a tactical mobile communication system in 2005+.

Author

Mobile Communication Systems; Research; Evaluation; Utilization

20000012207 Military Communication Inst., Network Management Dept., Zegrze, Poland

MANAGEMENT SYSTEM FOR MOBILE COMMUNICATION NETWORK USED IN THE POLISH ARMY

Mamcarz, Krzysztof, Military Communication Inst., Poland; Malowidzki, Marek, Military Communication Inst., Poland; Matyszkiel, Robert, Military Communication Inst., Poland; Szczygielski, Konrad, Military Communication Inst., Poland; Tactical Mobile Communications; November 1999, pp. 9-1 - 9-6; In English; See also 20000012198; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

The This paper describes a general conception and implementation details of the Mobile Communication Network Management System (MCNMS) developed for Polish Army. The prototype of MCNMS has been finished this year and checked in the field conditions during exercises in November '98. The following topics will be considered in this paper: (1) standardizations and recommendations of international organizations and groups taken into account while building conception and prototype of MCNMS, (2) general characteristics of MCNMS in terms of tactical aspects - hierarchy of management system, exchanging reports between signal officers, (3) the physical structure of MCNMS including its hardware elements: management shelters, management workstations, mediation devices up to network elements, (4) interfaces and communication protocols defined and used in MCNMS, (5) the structure of the management application, (6) interoperability issues, (7) realized and planned management functions, (8) some tested functions from field exercises, and (9) conclusions.

Author

Management Systems; Mobile Communication Systems; Communication Networks; Standardization

20000012208 G. S. Rakovski War Coll., Air Defense Dept., Sofia, Bulgaria

PRESENT AND NEAR FUTURE TACTICAL AIR DEFENCE OPERATIONS REQUIREMENTS

Nesterov, K. N., G. S. Rakovski War Coll., Bulgaria; Georgiev, N. L., Ministry of Defence, Bulgaria; Tactical Mobile Communications; November 1999, pp. 11-1 - 11-4; In English; See also 20000012198; Copyright Waived; Avail: CASI; A01, Hardcopy; A03, Microfiche

The Bulgarian Armed Forces are facing now a great challenge - urgent necessity of restructuring in order to gain higher efficiency and flexibility. This process must go on at the same time with the process of adopting the NATO standards. Well- timed execution of this process is a guarantee for the integration of the Bulgarian army's structures to the corresponding NATO structures and for performing new possibilities in accordance with the global political and military environment. In the current manuscript the focus will be on these problems and their solving in the Air Defence. The existing Bulgarian Air Defence system is established and developed in full correspondence with the military science of the past. Characteristics of it are all elements of Air Defence system that is deep layered, is capable to cover main strategic objects, directions and zones, and definitely is assigned to operate in military conflict of high intensity or in levels of geopolitical uncertainty and tension before the end of the Cold War. Main characteristics of the Air Defence are: 1. Strongly decentralized structure; 2. Many levels in the structure for gaining radar information and reporting the results of the surveillance; 3. In order to improve the survivability of the system there are large number of equipment and units.

Derived from text

Requirements; Air Defense; Flexibility; Surveillance

20000012209 DaimlerChrysler Aerospace A.G., Munich, Germany

MULTI-MODE RADIOS: THE WAY FORWARD TO FLEXIBLE MOBILE COMMUNICATIONS ON THE BATTLEFIELD

Hering, Gerhard, DaimlerChrysler Aerospace A.G., Germany; Tactical Mobile Communications; November 1999, pp. 12-1 - 12-10; In English; See also 20000012198; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

This paper introduces an approach to a Multi-Mode-Radio (MMR) for the use in a military tactical environment. The approach has been investigated under a German R&D- programme. From the required functionality a suitable architecture is derived and reasons for the design are presented. Technology needs in the field of Analog Digital Conversion and Digital Signal Processing are considered. Advantages and limitations which appear when operating a MMR in the field will be discussed.

Author

Radio Communication; Mobile Communication Systems; Research And Development

20000012210 Physics and Electronics Lab. TNO, The Hague, Netherlands

MODELING AND SIMULATION OF THE ZODIAC TACTICAL COMMUNICATION SYSTEM

Boltjes, Bert, Physics and Electronics Lab. TNO, Netherlands; Langeveld, J. G. M., Physics and Electronics Lab. TNO, Netherlands; Tactical Mobile Communications; November 1999, pp. 14-1 - 14-14; In English; See also 20000012198; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

This paper gives a description of the development of a simula-

tion model of the ZOne DIgital Automatic Cryptographic (ZODIAC) tactical communication system of the Royal Netherlands Army (RNLA). Also, examples of simulation results and some lessons learned will be presented. The ZODIAC tactical communication system of the Dutch Army consists of access equipment and mobile switches. The switches are typically interconnected via line of sight radio links. A deployment of a ZODIAC network has, like all communication systems, a finite capacity to handle traffic. The ZODSIM simulation model was developed to study properties of deployments and the impact of new equipment and services on the capacity and to predict bottle necks. The introduction presents a brief description of ZODIAC, features implemented in ZODSIM, the OPNET simulation environment used to develop the model, and some modeling techniques. In the section thereafter, some examples of simulations of deployments of ZODIAC and obtained results will be presented, followed by a discussion and some lessons learned.
Author
Models; Simulation; Tactics; Cryptography; Telecommunication

20000012211 Research Inst. of National Defence, Div. of Command and Control Warfare Technology, Linkoeping, Sweden
MODELING TERRESTRIAL MOBILE NETWORKS IN REAL TERRAIN
Joensson, Christian, Research Inst. of National Defence, Sweden; Groenkvist, Jimmi, Research Inst. of National Defence, Sweden; Sterner, Ulf, Research Inst. of National Defence, Sweden; Englund, Eva, Research Inst. of National Defence, Sweden; Hansson, Anders, Research Inst. of National Defence, Sweden; Soederquist, Ingrid, Research Inst. of National Defence, Sweden; Tactical Mobile Communications; November 1999, pp. 15-1 - 15-9; In English; See also 20000012198; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

The presentation given here, reflects the current state of an ongoing research project, with focus on tactical multi-hop radio near ground networks. For terrestrial mobile networks the terrain has a large impact, not only on radio link level, but also on network design and protocols. Our aim is to estimate and simulate network performance, and to evaluate network designs and protocols in a real terrain environment. Here, we describe our method and models for simulating network performance in digitized terrain. The method is based on estimating the basic-path-loss. It utilizes a digitized terrain and advanced electro-magnetic propagation models to model the impact of terrain. We present the proposed methods as well as an overview of current work, including: spatial reuse access schemes, mobility model and analyses of the duration of an access protocol.
Author
Terrain; Mathematical Models; Mobility; Network Analysis

20000012212 Turkish Land Forces Command, Technical and Project Management Dept., Ankara, Turkey
PERFORMANCE ANALYSIS OF DIRECT SEQUENCE SPREAD SPECTRUM AND NON-SPREAD SPECTRUM TECHNIQUES IN FREQUENCY SELECTIVE FADING CHANNELS
Torun, Erdal, Turkish Land Forces Command, Turkey; Zorba, H. Orkun, Aydin Yazilim ve Elektronik Sanayi A.S., Turkey; Tactical Mobile Communications; November 1999, pp. 16-1 - 16-7; In English; See also 20000012198; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

In a frequency selective fading channel where symbol rate is higher than the coherence bandwidth, both fading and delay spread effects are the severe impairments that should be combated. In this work, spread spectrum (SS) and non-spread spectrum (NSS) techniques together with different modulation schemes are investigated to combat these impairments for the high-speed data transmission in mobile environments. Simulation results of the techniques proposed are presented and alternative design parameters are given.
Author
Performance Tests; Spread Spectrum Transmission; Procedures; Frequencies; Selective Fading

20000012213 Leicester Univ., Dept. of Engineering, UK
HIGH LATITUDE OFF-GREAT CIRCLE PROPAGATION EFFECTS WITH REFERENCES TO HF COMMUNICATION SYSTEMS AND RADIOLOCATION
Warrington, E. M., Leicester Univ., UK; Jones, T. B., Leicester Univ., UK; Rogers, N. C., Leicester Univ., UK; Stocker, A. J., Leicester Univ., UK; Tactical Mobile Communications; November 1999, pp. 17-1 - 17-18; In English; See also 20000012198; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

Owing to the presence of tilts and gradients in the high latitude electron density distribution, HF radio signals often arrive at the receiver over paths well displaced from the great circle direction. Deviations of a few degrees are associated with tilts due, for example, to the solar terminator and to travelling ionospheric disturbances (TIDs). Very large deviations are particularly prevalent in the high latitude regions where signals often arrive at the receiver with bearings displaced from the great circle direction by up to +/- 100 deg or more. These large deviations from the great circle path are due to electron density depletion and the associated ionospheric tilts within the mid-latitude trough at sub-auroral latitudes, whereas in the polar cap they are attributed to the presence of convecting patches and arcs of enhanced electron density. In addition to the large scale tilts which cause gross deviations of the signal from the great circle direction, irregularities in the electron density distribution may be considered as providing a rough reflecting surface for HF radio waves. As a result of this roughness, signals associated with each propagation mode arrive at the receiver over a range of angles in both azimuth and elevation. Accordingly, a single ionospheric mode is often modelled as a single ray specularly reflected from a smooth ionosphere surrounded by a cone of rays produced by the roughness of the ionosphere - the former is referred to as the specular component and the latter as the scattered or diffracted component. The hypothesis of a specular component of constant amplitude and constant direction of arrival surrounded by a cone of scattered energy is an oversimplification in practice since the model carries an implication of a smooth ionosphere of infinite extent upon which are superimposed the localised irregularities leading to the scattered energy. No account is taken of larger scale, possibly time varying, tilts in the model. Various experimental measurements and their interpretation by researchers at the University of Leicester of off great-circle propagation over a range of high latitude paths are summarized in this paper.
Author
Electron Density (Concentration); Density Distribution; High Frequencies; Radio Signals; Experimentation; Geomagnetic Latitude; Ionospheric Tilts; Traveling Ionospheric Disturbances

20000012214 Space and Naval Warfare Systems Command, San Diego, CA USA
UHF MILSATCOM SYSTEMS WITH EMPHASIS ON CHANGES MADE BY THE RECENT INTRODUCTION OF AUTOMATIC CONTROL (AC) MODE DEMAND ASSIGNED MULTIPLE ACCESS (DAMA)
Huckell, Gary, Space and Naval Warfare Systems Command, USA; Parsons, James, Space and Naval Warfare Systems Command, USA; Tactical Mobile Communications; November 1999, pp. 18-1 - 18-11; In English; See also 20000012198; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

Ultra high frequency (UHF) military satellite communication (MILSATCOM) has been providing service to mobile users for more than twenty years, and has become the common denominator for Allied communications. Prior to 1992 there were no formal interoperability standards governing the use of the UHF satellite system. To increase the efficiency of use of UHF satellite communication resources and to improve interoperability, a series of UHF satellite communication standards were developed. The publishing of the standards, along with a Joint Staff mandate requiring use of terminals certified to the new standards, has resulted in a tremendous surge of interest in UHF satellite communication. As many as twenty thousand new terminals, certified to these standards, will be built over the next few years. This paper begins by describing the previous and current UHF satellite constellations and summarizes how UHF satellite communications are being used. The history and capabilities of the three main UHF satellite communication standards are described along with problems that have delayed the move to demand assigned multiple access (DAMA). The paper also describes the initial development and future plans fo r a decentralized communications planning and management tool that will assist with creating, approving, allocating and maintaining networks of certified terminals. The paper concludes by describing work being performed to increase channel control reliability, improve the quality of secure voice, increase data rates, and enhance the ability to accommodate

variable rate data protocols, including internet protocols.
Author
Ultrahigh Frequencies; Armed Forces; Satellite Communication; Automatic Control; Demand Assignment Multiple Access; Telecommunication

20000012215 Communications Research Centre, Terrestrial Wireless Systems, Ottawa, Ontario Canada
SIMULATION OF A COMBAT-NET MOBILE RADIO SYSTEMS WITH ARQ FEEDBACK ERRORS
Vigneron, P. J., Communications Research Centre, Canada; Moreland, K. W., Communications Research Centre, Canada; Tactical Mobile Communications; November 1999, pp. 19-1 - 19-9; In English; See also 20000012198; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

Performance trends are reported from a simulation study of a tactical radio system for the Canadian Army, a mobile digital packet radio system for data transmission. The primary combat-net radio system uses a continuous-phase frequency-shift keying modulation to achieve a transmission rate of 1600 information bits per second, and can operate at a slow frequency hopping rate. The radio data-link protocol employs forward error-correction (FEC) coding, which is the combination of a parity bit, a (23,12) Golay code and a repetition code, as well as an interleaver to combat the effects of fades in the channel. An automatic repeat-request (ARQ) scheme is also employed for the retransmission of coded data that cannot be corrected by the coding scheme. A description of the channel simulation, the error correction and interleaving schemes, and the operation of the ARQ protocol under conditions of reverse channel errors are made. Performance trends are identified.
Author
Simulation; Combat; Mobile Communication Systems; Radio Transmission; Automatic Repeat Request; Error Analysis; Feedback

20000012216 Defence Research Establishment Valcartier, Val Belair, Quebec Canada
TESTBED FOR THE EVALUATION OF BATTLEFIELD INFORMATION MANAGEMENT TECHNIQUES APPLIED TO A LOW BANDWIDTH TACTICAL WIRELESS COMMUNICATIONS ENVIRONMENT
St.Jacques, Jean-Claude, Defence Research Establishment Valcartier, Canada; Gibb, Allan W., Defence Research Establishment Valcartier, Canada; Tactical Mobile Communications; November 1999, pp. 20-1 - 20-8; In English; See also 20000012198; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

Mobile communication is an important military requirement. Voice communications still occupy a preeminent place in Army operations. Present-generation digital data communications at the tactical level (below Brigade) are often accomplished using radio systems designed primarily with voice in mind. Data throughput tends to be very limited (300-600 bits/second is not uncommon) and highly variable. If one regards the wireless communication network as a data pipeline, there are essentially three possible ways of improving the situation: (1) increase the size of the pipeline (new/improved radios or communications hardware - desirable, but often unaffordable); (2) optimize transmission through the pipeline (network management techniques); or (3) be as smart and efficient as possible about what is put into the pipeline. The potential of the third approach is often overlooked. This paper describes a testbed being developed to study the impact of information management techniques, applied at the level of the application database in each participating node of a simulated tactical radio network, on the quality and timeliness of information distribution across nodes.
Author
Evaluation; Data Bases; Information Management; Procedures; Wireless Communication; Communication Networks; Test Stands

20000012217 ASELSAN Military Electronics Industries, Inc., Communications Div., Ankara, Turkey
ISTAR RADIO NETWORK FOR TACTICAL USE
Eken, F., ASELSAN Military Electronics Industries, Inc., Turkey; Uzun, S., ASELSAN Military Electronics Industries, Inc., Turkey; Tactical Mobile Communications; November 1999, pp. 21-1 - 21-4; In English; See also 20000012198; Copyright Waived; Avail: CASI; A01, Hardcopy; A03, Microfiche

The tactical battlefield is now becoming a ground for extensive digital data exchange where many systems, sensors, weapons, command centers need to exchange high speed data in order to perform effectively. More so, these units need to carry out their data exchange while on the move because the new military doctrines heavily emphasize mobility and flexibility. Many tactical command control functions such as maneuver control, fire support, SHORADS (Short Range Air Defence System), electronic warfare, intelligence and logistics rely on tactical mobile radio communications. No army can afford to have dedicated and separate radio systems to support different applications. What is needed is a single tactical radio system that will be able to support most if not all the needs of the tactical area. Considering the requirements of the future battlefield a new concept for the future digital tactical radio has been introduced. This new concept is called iSTAR (Integrated Services Tactical Radio), VRC-5100. The iSTAR concept is based on radio networking and packet communications. On the tactical field, iSTAR radios automatically form a radio network where all the network management functions are carried out in a distributed fashion.
Author
Radio Communication; Radio Equipment; Data Acquisition; Ground Tests; Mobile Communication Systems

20000012218 Technische Univ., Communication Networks, Aachen, Germany
A WIRELESS AD HOC MULTIHOP BROADBAND NETWORK WITH QUALITY OF SERVICE SUPPORT
Lott, Matthias, Technische Univ., Germany; Walke, Bernhard, Technische Univ., Germany; Tactical Mobile Communications; November 1999, pp. 22-1 - 22-8; In English; See also 20000012198; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

In this paper a wireless ad hoc multihop network is described. The decentrally organized network is able to guarantee the bandwidth contracted to a connection in a hidden station environment by means of contention-free data transmission on real channel connections (RCCs) that are established and used for the duration when data have to be transmitted, and that are released otherwise. Protocols for the air interface of the proposed network that have been developed to support real-time oriented services with quality of service and that support the prioritized, quick re-establishment of real channel connections are described. The proposed algorithms efficiently exploits the available frequency spectrum and protects established links in a hidden and exposed station environment. Performance results for the ad hoc network with different connectivities are presented and indicate low delay and high utilization even for multihop operation.
Author
Wireless Communication; Communication Networks; Data Transmission; Real Time Operation; Broadband

20000012219 Tactical Area Communication System, International Project Office, Issy-les-Moulineux, France
A CONNECTION LEVEL PRIORITY/PRE-EMPTION SERVICE FOR ATM COMMUNICATION NETWORKS
Johnson, T. D., Tactical Area Communication System, France; Nourry, G., Communications Research Centre, Canada; Mellaney, Eldon J., Communications Research Centre, Canada; Rahman, H., Royal Military Coll. of Canada, Canada; Tactical Mobile Communications; November 1999, pp. 23-1 - 23-10; In English; See also 20000012198; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

The development of new services for ATM networks continues, yet one service still required is end-to-end Connection Level Priority/Pre-emption (CLPP). This paper details the CLPP requirement, presents factors affecting its implementation, and provides a solution for the implementation of this service in the control plane of the ATM protocol reference model. Also presented is an analysis of a subset of the results obtained from over three thousand CLPP OPNET simulations, which were continually refined over a three-year period.
Author
Communication Networks; Management Systems; Priorities; Asynchronous Transfer Mode; Requirements

20000012220 GEC-Marconi Research Centre, Borehamwood, UK
MOBILITY MANAGEMENT FOR TACTICAL ATM NETWORKS
Walker, P., GEC-Marconi Research Centre, UK; Tactical Mobile Communications; November 1999, pp. 24-1 - 24-10; In English; See

also 20000012198; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

This paper evaluates the current and proposed ATM standards for COTS equipment against tactical network requirements. It presents a set of requirements and describes some of the schemes under consideration in the ATM Forum to implement mobility. It concludes that the emerging ATM standards that enable terminal mobility are worthy of consideration for tactical networks, as are those for switch mobility in a non-operational state. However, some features, such as operational switch mobility and connection preemption, require further standards development.
Author
Mobility; Management; Asynchronous Transfer Mode; Networks

20000012221 Norwegian Defence Research Establishment, Kjeller, Norway
PROPOSED CONCEPT FOR A NON-LOS TACTICAL WIRELESS LAN
Haavik, Svein, Norwegian Defence Research Establishment, Norway; Tactical Mobile Communications; November 1999, pp. 25-1 - 25-7; In English; See also 20000012198; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

New concepts for land warfare and the increasing use of civilian computer and communications systems are leading to a demand for more bandwidth on the battlefield. The introduction of dispersed command posts with wireless LAN (WLAN) interconnection is a tough challenge for communications systems designers, especially when combined with a requirement for mobility and ease of operation. super high frequency (SHF) - systems to be used in forest terrain will need high antenna masts or must try to overcome the large propagation loss caused by vegetation. We are investigating the possibility of operating a high-capacity SHF-based LAN-system for dispersed command posts in typical Norwegian terrain, allowing for line of sight to be obstructed by vegetation.
Author
Wireless Communication; Local Area Networks; High Frequencies; Interprocessor Communication; Superhigh Frequencies; Warfare

20000012222 North Atlantic Treaty Organization, Radio Branch, The Hague, Netherlands
SPREAD SPECTRUM AND MOBILE/TACTICAL-RADIO/WIRELESS COMMUNICATIONS
Yavuz, Davras, North Atlantic Treaty Organization, Netherlands; Tactical Mobile Communications; November 1999, pp. 26-1 - 26-6; In English; See also 20000012198; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

Spread spectrum techniques are one of the primary technologies that have driven the proliferation of radio (or wireless) communications. However, these spread spectrum techniques were originally developed for overcoming noise/interference effects. Subsequently they were the enabling technology of for space communications providing processing gains essential for long distance space communications. More recently these techniques have provided, and continue to provide, one of the essential ingredients for the proliferation of mobile mid multiple-access communications. Shannon's fundamental work laying the foundations of information theory has as the corner-stone spread spectrum theory and we will first cover briefly bandwidth expansion bounds for spread spectrum systems derived from Shannon's capacity limits. These show the exponential improvements possible through expanding the bandwidth of a baseband signal for transmission. In spite of the fact that they do not provide any hints on how that could be achieved, these results are significant for testing known systems. An interesting conclusion from these is that, for example, single-side-band suppressed carrier systems are optimum from this perspective. There are many electromagnetic propagation related effects; reflection, diffraction, scattering, multipath, large & small-scale fades, delay spread effects. These effect all radio/wireless communications and specifically mobile links (=at least one end of the link is rapidly deployable and/or moving). With mobility additional issues also arise from limitations in antenna size, pointing stability if directionality is required, absorption/scattering effects in forest/foliage, extreme changes in local ground conductivity conditions, characteristics of the mobile platform/vehicle,... etc. Spread spectrum techniques, in general, reduce the detrimental effects of most of these, to some degree, through primarily the averaging effects inherent in the use of a large bandwidth for transmission. Some these will be exemplified and elaborated in the context of tactical/mobile radio systems, including conventional frequency hopping systems and such systems as JTIDS GSM, TETRA, Iridium, wireless LANs, ...
Author
Spread Spectrum Transmission; Mobile Communication Systems; Wireless Communication; Procedures; Multiple Access; Radio Communication

20000012223 North Atlantic Treaty Organization, Frequency Management Branch, Brussels, Belgium
TACTICAL MOBILE RADIOCOMMUNICATIONS: A CHALLENGE FOR MILITARY FREQUENCY MANAGEMENT
Bingel, P., North Atlantic Treaty Organization, Belgium; Trautmann, E., North Atlantic Treaty Organization, Belgium; Taylor, T. J., North Atlantic Treaty Organization, Belgium; Tactical Mobile Communications; November 1999, pp. 27-1 - 27-9; In English; See also 20000012198; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

The increasing demand for information at all levels of the military places a great demand on tactical mobile radiocommunications and the supporting radio frequency spectrum resources. Military frequency managers have been able to operate using agreed civil/military provisions of the frequency spectrum in close coordination with Civil Authorities. It appears, however, that civilian radiocommunications users are demanding more and more spectrum for high value commercial purposes. Civilian operators have been challenging the reservation of spectrum for critical military systems for several years and this became particularly evident at World Radiocommunication Conferences (WRC). The military community can expect more of such challenges in the future. These challenges often mean seeking specific agreements for spectrum based on specific systems. This leaves little room for new military technology growth and even less for increases in spectrum demand to meet growing information transfer requirements. This challenge increases rapidly when considering that efficient operations are dependent on flexibility, mobility and interoperability while being employed across international borders. Embedded in these challenges, however, are opportunities to counter deficient military spectrum requirements through the utilisation of civilian commercial systems.
Author
Mobile Communication Systems; Radio Communication; Military Technology; Frequency Distribution; Management

20000012224 Defence Procurement Agency, Electronics and Optronics Div., Bern, Switzerland
DIGITAL COMMUNICATION AND MULTIPATH PROPAGATION
Zehntner, Christoph, Defence Procurement Agency, Switzerland; Patry, Christian, Defence Procurement Agency, Switzerland; Maier, Markus, Defence Procurement Agency, Switzerland; Tactical Mobile Communications; November 1999, pp. 28-1 - 28-6; In English; See also 20000012198; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

Multipath propagation with tactical VHF radios is investigated in a mountainous terrain. Depending on transmitting frequency, echo time delay and receiver signal bandwidth, distortion in analog and intersymbol interference in digital systems is caused. The behavior of digital fixed frequency (FF) and frequency hopping (FH) radios is examined. Methods are described to measure multipath propagation in the terrain as well as to simulate it in the laboratory, The analysis of the multipath performance of the new Swiss tactical radio SE-235 led to a modification to improve the synchronization characteristics.
Author
Digital Systems; Communication; Multipath Transmission; Propagation (Extension); Very High Frequencies; Distortion

20000012225 Communications Research Centre, Ottawa, Ontario Canada
HF SERIAL-TONE WAVEFORM DESIGN
Jorgenson, M. B., Communications Research Centre, Canada; Moreland, K. W., Communications Research Centre, Canada; Tactical Mobile Communications; November 1999, pp. 33-1 - 33-10; In English; See also 20000012198; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

The intent of this paper is to provide the reader with an understanding of the fundamental aspects of HF serial-tone waveform design. Factors which affect the design of a waveform are

discussed Some factors are regulatory, for example, the availability of bandwidth. Others are a consequence of nature, such as the characteristics of the HF channel. The technology used in the detection of serial-tone signals plays a key role in the design of the waveform. The component elements of a serial-tone modern are briefly described. Empirical waveform performance rules are presented and the design process is illustrated with an example based on the development of a 9600 bps HF waveform standard.
Author
High Frequencies; Waveforms; Design Analysis

20000012226 Communications Research Centre, Ottawa, Ontario Canada
BEYOND 9600 BPS AT HF
Jorgenson, M. B., Communications Research Centre, Canada; Johnson, Robert, Communications Research Centre, Canada; Moreland, K. W., Communications Research Centre, Canada; Tactical Mobile Communications; November 1999, pp. 34-1 - 34-8; In English; See also 20000012198; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

This paper focusses on the emergence of high data rate HF data communications capabilities providing data rates of 9600 bps and beyond. The use of independent sideband equipment and allocations is suggested as a feasible means of providing data rates of up to 32 kbps, particularly in a naval environment where surface wave propagation extends well beyond line of sight. Results obtained with a modem implementation and HF channel simulator are presented to substantiate claims that the performance is acceptable for many naval scenarios.
Author
High Frequencies; Rates (Per Time); Data Transmission; Wave Propagation

20000012227 Norwegian Defence Research Establishment, Kjeller, Norway
THE HIGH LATITUDE PERFORMANCE AND AVAILABILITY OF STANAG 4415 USING MULTIPLE FREQUENCIES
Bergsvik, Torgeir, Norwegian Defence Research Establishment, Norway; Jodalen, Vivianne, Norwegian Defence Research Establishment, Norway; Tactical Mobile Communications; November 1999, pp. 35-1 - 35-6; In English; See also 20000012198; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

The high latitude HF channel has been measured and characterized in terms of Doppler spread, delay spread and signal-to-noise ratio. The performance of data modems compliant with STANAG 4285 (2400 bps mode, non-robust) and STANAG 4415 (75 bps, robust) has been determined over a comprehensive range of simulated channel conditions. A comparison is made between the channel measurements and the modem characterizations, and modem availabilities during the measured channel conditions are determined. The robust modem shows 50-70% higher availability than the non-robust modem on the measured paths. The most important factor contributing to modem failure is low signal-to-noise ratio. The paper also addresses the number of frequencies required for a HF circuit to achieve maximum communications availability. On a 1500 km path it is shown that the STANAG 4285 modem requires 6-8 frequencies whereas the STANAG 4415 modem reaches maximum availability with 2-3 frequencies.
Author
High Frequencies; Performance Tests; Availability; Data Processing Equipment

20000012228 North Atlantic Treaty Organization, Frequency Management Branch, Brussels, Belgium
EMC ANALYSIS ON VHF COMBAT NET RADIO (CNR) IN AIRBORNE APPLICATIONS
Kho, K. S., North Atlantic Treaty Organization, Belgium; Tactical Mobile Communications; November 1999, pp. 29-1 - 29-11; In English; See also 20000012198; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

Usage of VHF Combat Net Radios (CNR) on airborne platforms will be contrary to the present coordination agreements with some NATO nations. For instance, in Germany, the military VHF band can be used without further coordination with the German Civil authority, provided that the restriction to e.g. the antenna height of 5 m is not violated. As a concession, use in helicopters is also permitted, but usage in fixed-wing aircraft requires additional coordination with the national authorities. This paper is made to contribute to discussions on an appropriate balance between the interference risk from airborne use of CNR and the operational requirement. The analysis will first be based on co-channel interference. The results will then be extrapolated to cases where frequency separation plays a role and to operation in Free Channel Search (FCS) and Frequency Hopping (FH) modes.
Author
Electromagnetic Compatibility; Very High Frequencies; Combat; Radio Equipment; Network Analysis; Coordination; Airborne Equipment

20000012229 National Security Agency, Fort Meade, MD USA
NOISE PRE-PROCESSING FOR TACTICAL SECURE VOICE COMMUNICATIONS
Collura, John S., National Security Agency, USA; Tactical Mobile Communications; November 1999, pp. 30-1 - 30-6; In English; See also 20000012198; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

Recent advances in speech enhancement and noise preprocessing algorithms have dramatically improved the quality and intelligibility of speech signals, both in the presence of acoustic background noise and in more benign environments. The use of speech enhancement algorithms combined with voice coding algorithms and applied to secure wireless communications systems is an area of increasing importance to the tactical user community. This paper will present the experience of the US. Government with respect to the selection and subsequent improvement of the 2.4 Kbps Mixed Excitation Linear Prediction (MELP) speech coding algorithm. A new 1.2Kbps version of the MELP algorithm intended for the tactical user will also be discussed.
Author
Noise (Sound); Voice Communication; Tactics; Security; Speech Recognition; Algorithms; Wireless Communication

20000012230 National Security Agency, Fort Meade, MD USA
ENHANCED ERROR CORRECTION OF THE US FEDERAL STANDARD MELP VOCODER EMPLOYING RESIDUAL REDUNDANCY FOR HARSH TACTICAL APPLICATIONS
Rahikka, Douglas J., National Security Agency, USA; Fuja, Thomas E., Notre Dame Univ., USA; Fazel, Tahereh, Maryland Univ., USA; Tactical Mobile Communications; November 1999, pp. 31-1 - 31-6; In English; See also 20000012198; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

The U.S. government has developed, adopted, and promulgated a new Federal Standard vocoder algorithm which operates at 2400 bps and is called MELP - Mixed Excitation Linear Prediction. This vocoder has reasonably good voice quality under benign error channel conditions. However, when subjected to high error conditions as may be experienced in vehicular applications, correction techniques may be employed which take advantage of the inherent inter-frame residual redundancy of the MELP parameters. This paper describes experiments conducted on the MELP vocoder algorithm in combination with Viterbi convolutional error decoding, and enhanced with Maximum A Posteriori techniques which capitalize on the redundancy statistics. Both hard and soft Viterbi decoding implementations are investigated.
Author
Error Analysis; Correction; Standards; Vocoders; Algorithms

20000012231 Ministry of Defence, CIDA, Madrid, Spain
STILL IMAGE TRANSMISSION IN A LINK 16 NETWORK USING EMBEDDED ZEROTREE WAVELET (EZW) ALGORITHM
Martinez-Ruiz, Manuel, Ministry of Defence, Spain; Artes-Rodriguez, Antonio, Alcala de Henares Univ., Spain; Tactical Mobile Communications; November 1999, pp. 32-1 - 32-13; In English; See also 20000012198; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

The transmission of tactical images via Link 16 standard is meant to be of a great operational importance. It is necessary to reach acceptable image compression rates to optimize the Link 16 network resources: the time slots corresponding to the TDMA architecture. These time-slots are also shared by the Link 16 tactical messages in accordance to the STANAG 5516. This paper addresses an application to image transmission via Link 16 Standard

for tactical data communication based on the Embedded Zerotree, Wavelet algorithm, sending with higher anti-jamming and error detection and correction (EDC) protection the parts of the image with higher impact on image quality. The Link 16 transmission protocol as well as the Embedded Image Coding allow the development of a combined algorithm to take advantage of both concepts. We present a Link 16 messages type allocation algorithm matched to the multiresolution representation of images obtained by the EZW algorithm. It is shown both the different anti-Jamming and the EDC capabilities. Each packing type requires an accurate data rate and this is in line with the EZW algorithm characteristics. The paper organization is as follows: the operational aspects for image transmission over any data link system are presented in Section 2. Section 3 discusses the EZW algorithm. A hierarchical organization of the information is desirable in order to obtain a multiresolution representation of the still image to be transmitted. Section 4 discusses the features of the Link 16 transmission. The Link 16 TDMA architecture is based on a time slot structure. Several data rates are allowed in a slot-by-slot basis. The above mentioned presents operational involvement in both the anti-jamming protection and the System ECD features. The operational range is also related with the Link 16 message structure and therefore it depends on both the antijamming capability and the data rate. Section 5 discusses the allocation algorithm of the different data rates to the image's hierarchical representation, based on the EZW approach Finally, a conclusion and several areas of Further research are presented.
Author
Image Resolution; Data Transmission; Networks; Wavelet Analysis; Algorithms

20000012232 North Atlantic Treaty Organization, Radio Branch, The Hague, Netherlands
MOBILE INTERNET/INTRANET ACCESS
Yavuz, Davras, North Atlantic Treaty Organization, Netherlands; Vollebregt, Paul, North Atlantic Treaty Organization, Netherlands; Tactical Mobile Communications; November 1999, pp. 36-1 - 36-5; In English; See also 20000012198; Copyright Waived; Avail: CASI; A01, Hardcopy; A03, Microfiche

The phenomenal expansion of Internet/Intranet services/networks has been driven by six technologies: 1. Semiconductor computer/processor and memory developments. 2. Photonic/fiber-optic transmission revolution. 3. Signal processing and related software developments. 4. Packet switching, protocol and related developments. 5. WWW/HTML standards/developments. 6. Magnetic/optical storage developments. These advances have of course also impacted many other areas but the emergence of Inter/Intranets and the previously unimaginable services provided by them is definitely the most significant. These developments now make mobile access to Inter/Intranets desirable and in some cases essential in many applications. TCP/IP (IP V4) which is the backbone of present Inter/Intranets, was not intended to support mobile users but available/ongoing mobile IP and IP V6 developments will soon provide some of the additional required functionality. In the meantime useful mobile access can be provided with suitable gateways as has been demonstrated by various implementations by STC/NC3A in the past three years. When considering mobility, distinction must be made of line-of-sight (LOS) and non/beyond LOS access. With LOS access capacity limitations are much less severe. With non-LOS access capacity available depends whether an active relay (e.g. SATCOM) is available or not. The type of satellite (GEO, MEO, LEO) will determine the size, characteristics of the mobile transceiver. Mobile nonLOS access relying on ionospheric or other natural phenomena has severe capacity limitations and as a result, services/applications intended for fixed networks are not generally suitable. However, such services as e-mail, browsing web sites with minimal graphics can be highly practical. We will focus on non-LOS access as this has important tactical applications in mountainous terrain and for long distance access in terrain virgin from a communications infrastructure viewpoint. STC/NC3A has implemented a non-LOS access system using the STC packet radio protocol developed in 1991 with a single-tone modem. The system was used in 1997 during joint trials with Norway on a coast-guard/icebreaker ship in the Norwegian polar seas from locations as far north as 83 deg. Internet gateway/access was through the STC/NC3A remote site at Staelduijnen. Since then this gateway has been available for various trials and continues to be made available on request. It has been estimated that six or seven such gateways suitably located in NATO member nations and with appropriate frequency management could provide Internet access essentially from any location. Details of the system used and some of the results of these trials will be presented. Some information on the mobile IP activities will also be given.
Author
Mobility; Internets; Computer Networks; Magnetic Storage; Memory (Computers)

20000031944 Research and Technology Organization, Information Systems Technology Panel, Neuilly-sur-Seine, France
DATABASES FOR ASSESSMENT OF MILITARY SPEECH TECHNOLOGY EQUIPMENT *[LES BASES DE DONNEES POUR L'EVALUATION DES EQUIPEMENTS DE TECHNOLOGIE VOCALE MILITAIRE]*
South, Allan, Defence Evaluation Research Agency, UK; March 2000; 30p; In English; CD-ROM: CD-ROM contains the entire technical report
Report No.(s): RTO-TR-25; AC/323(IST)TP/6; ISBN 92-837-1028-2; Copyright Waived; Avail: CASI; A03, Hardcopy; A01, Microfiche; C01, CD-ROM

A NATO research group carried out collaborative studies on military applications of speech processing. A major requirement in this area of work is for large quantities of speech recordings made in military environments, which are often expensive and difficult to obtain. Research and development in this area will benefit from sharing such data as widely as possible among the NATO research community. The cost of collecting speech recordings under realistic military conditions is high. Considerable cost savings may be made if such data are shared as widely as possible amongst the NATO community. The NATO research group on speech processing will continue to maintain and update the database of speech recordings relevant to military applications of speech technology. Further ways of disseminating this information will be sought, including electronic means such as the Internet.
Author
Military Technology; Data Bases; Speech; Voice Data Processing; Data Acquisition; Voice Communication

20000031945 Research and Technology Organization, Information Systems Technology Panel, Neuilly-sur-Seine, France
THE IMPACT OF SPEECH UNDER 'STRESS' ON MILITARY SPEECH TECHNOLOGY *[L'IMPACT DE LA PAROLE EN CONDITION DE 'STRESS' SUR LES TECHNOLOGIES VOCALES MILITAIRES]*
Vloeberghs, Claude, Research and Technology Organization, France; Verlinde, Patrick, Research and Technology Organization, France; Swail, Carl, Research and Technology Organization, France; Steeneken, Herman, Research and Technology Organization, France; vanLeeuwen, David, Research and Technology Organization, France; Trancoso, Isabel, Research and Technology Organization, France; South, Allan, Research and Technology Organization, France; Moore, Roger, Research and Technology Organization, France; Cupples, E. James, Research and Technology Organization, France; Anderson, Timothy, Research and Technology Organization, France; Jansen, John, Research and Technology Organization, France; March 2000; 115p; In English; CD-ROM: CD Rom contains the entire technical document
Report No.(s): RTO-TR-10; AC/323(IST)TP/5; ISBN 92-837-1027-4; Copyright Waived; Avail: CASI; A06, Hardcopy; A02, Microfiche; C01, CD-ROM

Military operations are often conducted under conditions of stress induced by high workload, sleep deprivation, fear and emotion, confusion due to conflicting information, psychological tension, pain, and other typical conditions encountered in the modern battlefield context. These conditions are known to affect the physical and cognitive abilities of human speech characteristics, and this study was intended to determine the actual effects of stress on voice production quality. It is suggested that the effect of operator based stress factors on voice is likely to be detrimental to the effectiveness of communication in general, in particular to the performance of communication equipment and weapon systems equipped with vocal interfaces (e.g., advanced cockpits, command, control, and communication systems, information warfare). Progress in the field of military based speech technology, including advances in speech based system design has been restricted due to the lack of availability of databases of speech under stress. In particular, the type of stress which an operator may experience in the modern battlefield

context is not easily simulated, and therefore it is difficult to systematically collect speech data for use in research and speech system training. It is foreseen that in the future it will be necessary to improve the coordination of multi-national military forces. The need therefore exists for planned simulations with military personnel using a wide range of speech technology and addressing factors such as high workload, sleep deprivation, fear and emotion, confusion, psychological tension, pain, etc.
Author
Military Operations; Military Technology; Speech Recognition; Voice Communication; Stress (Physiology); Human Factors Engineering; Stress (Psychology)

20000032361 Research and Technology Organization, Studies, Analysis and Simulation Panel, Neuilly-sur-Seine, France
MODELLING AND ANALYSIS OF COMMAND AND CONTROL ***[MODELISATION ET ANALYSE DE PROCESSUS DE COMMANDEMENT ET DE CONTROLE]***
June 1999; 364p; In English; In French; 12-14 Jan. 1999, Moulineaux, France; See also 20000032362 through 20000032387 Report No.(s): RTO-MP-38; AC/323(SAS)TP/12; ISBN 92-837-0010-4; Copyright Waived; Avail: CASI; A16, Hardcopy; A03, Microfiche

The main objective for this Symposium was to exchange the latest research information in selected focus areas that must be addressed when conducting systematic and disciplined evaluation of C3I systems. A second objective was to provide an opportunity for NATO countries and PfP nations representatives to discuss examples of current best practices in C31 research, modeling, and analysis with recognized experts in the field. The Symposium consisted of six sequential sessions and was based on the format used by the SAS-002 team to assemble its 'Code of Best Practice for the Assessment of Command and Control' [RTO publication TR-9, AC/323(SAS)TP/4]. The opening session comprises a keynote address by French General Marescaux, an overview of the work of the SAS-002 team, and a presentation on significant aspects and contributions of the team's work. The other sessions are on Measures of Merit (Session 1), Modeling and Simulations (Session 2), Human Factors and Organizations (Session 3), Applications (Session 4), and Special Topics (Session 5).
Derived from text
Command And Control; Communication; Decision Support Systems; Intelligence; Conferences; Computer Techniques; Defense Program

20000032362 Defence Evaluation Research Agency, Centre for Defence Analysis (High Level Studies), Farnborough, UK
THE ANALYSIS OF COMMAND AND CONTROL
Moffat, James, Defence Evaluation Research Agency, UK; Modelling and Analysis of Command and Control; June 1999, pp. 1-1 - 1-16; In English; See also 20000032361; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

Across NATO, there is a growing realisation that the proper representation of Command and Control (C2) within combat models is very important. Some of the reasons for this are: (a) to show the cost-effectiveness of investment in C2 systems, (b) to support Defence programmes such as 'Digitization of the Battlespace', and (c) the need to represent C2 in order to properly represent overall force behaviour and effectiveness. This includes the need to incorporate emerging understanding of the human impact on operational effectiveness. There is thus an urgent need to develop methods of properly representing these effects. In consequence, research has been instigated in the UK to investigate ways in which the effects of C2 can be incorporated successfully into constructive simulation models of combat - i.e. simulation models which can run in closed form on a computer, and represent the effects of C2, without the need for human intervention during the simulation run. A major pressure acting on defence operational research studies is the need to address a wider span of likely futures (scenarios) in studies, reflecting increased uncertainty in the post-Cold War world. Another reflection of this uncertainty is the need to consider a wide range of sensitivity analysis, and to do this quickly enough to influence the political process. These point to the need for constructive simulation models, incorporating the effects of C2, which run at rates very much faster than real time, and which are easily transportable across different situations and scenarios. There have been several attempts in the last thirty years to develop simulation models of war which have a proper representation of the C2 process. Proper here means sufficiently good that the models can be used with confidence for studies to advise ministers and other high level public sector decision-makers on major defence budget expenditure (running to billions of pounds) and preferred future force structures for the defence of the country. In such circumstances Operational Analysis (as Operational Research is called in the Ministry of Defence) is subject to another pressure which is to represent processes in sufficient detail to give confidence that the results can be trusted. There is thus a need to strike a balance between such detail and the need for rapid analysis of alternatives. This is the key research challenge.Previous attempts at representing the C2 process in the NATO defence communities have adopted rule based approaches based on expert systems. These have led to models which are slow, difficult to understand, and very difficult to transfer from one scenario to another. They are thus not suited to the new post-Cold War defence environment. A new approach is laid out here, which shows sufficient promise that the ideas concerned are being incorporated into the next generation of simulation models under development at the Centre for Defence Analysis. These models are designed to span the range of likely future defence environments, ranging across Land, Sea and Air, and including lower level operations such as Peacekeeping.
Author
Command And Control; Computerized Simulation; Mathematical Models; Combat; Real Time Operation; Warfare; Expert Systems; Military Operations

20000032363 Norwegian Defence Research Establishment, Kjeller, Norway
REFLECTIONS ON THE USE OF THE 'RSG-19 COBP REPORT' IN C2-ANALYSIS PROJECTS
Langsaeter, Tor, Norwegian Defence Research Establishment, Norway; Modelling and Analysis of Command and Control; June 1999, pp. 2-1 - 2-10; In English; See also 20000032361; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

RSG-19 has completed a Code Of Best Practice (COBP) for the analysis and modelling of Command and Control (C2). FFI has recently conducted a major command and control analysis project for the Norwegian Army, and I have asked myself the hypothetical question: How could this project have benefited from a COBP if it had existed at the time when the project started? I quickly could think of several ways in which the COBP could have been useful, but the potential most important one I had not anticipated when I first asked myself the question. As a result of this thinking process I realised that it was not easy to get a clear appreciation of the value of the COBP in relation to a specific analysis. Therefore I thought my reflections on how the COBP may have been used, and speculations on what impact such use may have had for the result of our study, could be of interest to others, in particular those who are or will be involved in similar studies in the future. Most people making an overall assessment of our C2-project would conclude that the project ended up as a success. However, success is a relative term, and we also experienced serious difficulties during the project of both methodological and project management nature. I have concluded that the potentially most important contribution of a COBP had it existed, would have been to improve the communication within the project team and thus facilitate the project management. This is what I am going to expand on during this presentation. As a background for explaining how I think the COBP could have been used I need to tell you about the project and explain some of the problems we encountered in the study process.
Author
Command And Control; Project Management; Management Planning; Mathematical Models

20000032364 Evidence Based Research, Inc., Vienna, VA USA
COMMAND AND CONTROL EVALUATION IN THE INFORMATION AGE
Kirzl, John E., Evidence Based Research, Inc., USA; Modelling and Analysis of Command and Control; June 1999, pp. 3-1 - 3-13; In English; See also 20000032361; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

The advent of the information age is rapidly accelerating the exchange of information between military components. To take full

advantage of the anticipated benefits of the information age, the military is being forced to rethink the way in which it conducts business and organizes the battlefield. The greatest impact of the information age will be on the command and control systems and processes, and in how to apply tile new capabilities of the information age to increase the speed and quality of decision making. In order to understand how to improve the command and control process, it is necessary to understand what that process is in its basic form. Command and control can be said to consist of a set of primitive functions. These are called primitive because they have historically been shown to be part of any C2 system regardless of the technology or doctrine applied. The functions consist of those necessary to provide the required information to the decision maker and the command and control processes that enable situation assessment, planning, and execution. The information functions include: Seek information, Retrieve information, Archive information, Inform population, Disseminate information, Consult with staffs and decision makers, Report out to staffs and decision maker, and Present information to staffs and decision makers. The information functions enable the command and control processes of: (1) Comprehension of the operating environment which consists of the intelligence, surveillance and reconnaissance process (ISR), and fusion of data and information (identify, situation assessment, threat assessment, action assessment); (2) Understanding which is a sufficient comprehension of the nature of the situation such that action is enabled; (3) Decision making which is the process of course of action (COA) development and assessment, uncertainty management, setting of criteria, and prioritizing; (4) Decide which is the selection of a course of action and the decision to implement it; and (5) Battle management which consists of the creation of a plan or replan and the associated implementation orders.
Author
Command And Control; Decision Making; Information Systems; Information Dissemination; Decision Support Systems

20000032365 Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek, Fysisch en Elektronisch Lab., The Hague, Netherlands
THE ROLE OF C3I IN FIELD ARTILLERY SIMULATION
Kurstjens, S. T. G. L., Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek, Netherlands; Modelling and Analysis of Command and Control; June 1999, pp. 4-1 - 4-11; In English; See also 20000032361; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

In the years 1997 and 1998 the simulation model SMART, which stands for Simulation Model ARTillery, to support the Dutch army in decision making. Main goal was to derive the optimal number and type of Howitzers, and organization of batteries and platoons, in a battalion. Two scenario settings were used to evaluate the performance of the field artillery system. In the first scenario a division appearance in a general defence task (full war) was simulated. In the second simulation a scenario of a brigade in a Peace Enforcing scenario was analysed. In the model the following components were explicitly modelled: Detection resources, Command and Control cells, Fire units, and Units of the enemy. In this model the enemy is modelled as black box and the actions of own forces do not influence the operations of enemy troops. As a consequence damage to own facilities was modelled as a parameter and only inflicted a possible damage after each round of fire. In the model of the Command and Control structure is inflexible. Networks and lines of communications are hard-coded and require a major adaptation in the model when changed. In the near future specific research questions of the Dutch army are expected concerning the Command and Control structure and lines of communications in the field artillery. We expect SMART to be not flexible enough to support these research themes. Therefore the decision was made to build a new research tool called SMARTER (Simulation Model ARTillery Extended and Revised). This paper consists of 5 chapters and is build up as follows. In chapter 2 the goal of the tool will be described. In chapter 3 we will describe how we think SMARTER can be used in a scenario setting. Chapter 4 will describe the elements, processes and measures which will be implemented in the tool SMARTER. In chapter 5 this paper will be concluded.
Author
Command And Control; Decision Making; Computerized Simulation; Mathematical Models; Warfare; Artillery

20000032366 Norwegian Defence Research Establishment, Kjeller, Norway
EVALUATING EFFECT OF C2 ON BATTLE OUTCOME BY TRACKING INFORMATION QUALITY
Sundfor, Hans Olav, Norwegian Defence Research Establishment, Norway; Modelling and Analysis of Command and Control; June 1999, pp. 5-1 - 5-13; In English; See also 20000032361; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

During the period 1994-97 FFI performed a large scale cost effect analysis of alternative C2-systems for the Norwegian Army division. Included in this was a study of the effect on expected battle outcome of the main C2 capabilities. The methodology that was used, is currently being refined and further developed, and will be used in future C2 analyses at the institute. The part of this methodology explicitly addressing the relation between C2 efficiency and battle outcome is outlined in the first part of the paper. The methodology consists in mapping alternative courses of a scenario, and then calculating the C2-systems ability to control the development onto a course giving a preferred endstate. In the second part an applied example taken from the past analysis is explained.
Author
Command And Control; Warfare; Decision Making; Cost Analysis

20000032367 EDS Defence Ltd., Fleet, UK
ANALYSIS OF COMBAT SYSTEM DEMANDS ON A C3IS ARCHITECTURE
Ashton, M., EDS Defence Ltd., UK; Miller, G. D., Defence Evaluation Research Agency, UK; Morgan, P. D., EDS Defence Ltd., UK; Modelling and Analysis of Command and Control; June 1999, pp. 6-1 - 6-10; In English; See also 20000032361
Contract(s)/Grant(s): MOD-CDA/E/295; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

A military Command, Control, Communications and Intelligence System (C3IS) provides a Commander with the means of directing and coordinating the operation of his combat resources to achieve his tactical objectives within his operational environment; this requires that the facilities provided by the C3IS match the scope of the tactical objectives, the vagaries of the operational environment and the demands of the various combat resources. In general, C3IS development has followed an evolutionary path in response to the progressive improvement of individual combat systems; however, there are a few occasions when the introduction into service of a new combat system has led to the need to examine the implications for the C3IS. The majority of these have been when the combat system offered a major improvement to the war fighting capability of the force; the arrival during the next few years of the Attack Helicopter (AH) into the British Army's inventory is perceived to be just such an occasion. The modern Attack Helicopter with its onboard mission planning systems and its data transfer communication capabilities is expected to have a major influence on future C3IS requirements of ground forces. The introduction of the Attack Helicopter with its range of new and extended capabilities will enhance the British Army's effectiveness and range of options in a variety of scenarios; however, the control and management of these new capabilities are expected to place new demands on the C3IS which may require modification or extension of the existing C3IS architecture. This paper describes an integrated modelling approach that was developed to support investigation of the C3IS and AH Mission Management System capabilities that will be needed to maximize the effectiveness of battlefield aviation; it discusses the application of the approach, showing how it was used to meet the study requirements.
Derived from text
Command And Control; Helicopters; Support Systems; Combat; Information Systems; Mission Planning; Management Systems

20000032368 Norwegian Defence Research Establishment, Kjeller, Norway
AN APPROACH TO MODEL DEVELOPMENT FOR EFFECTIVENESS ANALYSIS OF COMMAND AND CONTROL SYSTEMS
Thorsen, Ulf, Norwegian Defence Research Establishment, Norway; Malerud, Stein, Norwegian Defence Research Establishment, Norway; Feet, Else Helene, Norwegian Defence Research Establishment, Norway; Brathen, Karsten, Norwegian Defence Research Establishment, Norway; Modelling and Analysis of Command and Control; June 1999, pp. 7-1 - 7-10; In English; See also 20000032361; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

This paper describes model development as part of a cost effectiveness analysis of Command and Control Systems (C2S). The modelling method is developed by and applied in an on-going analysis at the Norwegian Defence Research Establishment (FFI), addressing development of a future C2S for the Royal Norwegian Navy. The scope of the study is the naval tactical level and the maritime part of the joint operational C2 level. The aim of this paper is to present an approach for model development in the context of effectiveness analyses, and as an introduction to this, the framework for cost effectiveness analysis is outlined in order to relate the modelling process to the analysis. The outline gives an overview of the cost effectiveness analysis used to distinguish between a set of system alternatives. Given this overview, we focus on model development and simulations in general and model development in connection with C2S in particular (i.e. the level between sub system analyses and operational consequences). The general part of the model development establishes a hierarchy of desired C2S properties, Measures of Merit (MoMs), and models and experiments used to measure MoMs for each of three modelling levels established for this analysis. The three levels are the C2 sub system level, the C2S level and the operational level. Examples of sub system level models are introduced. C2S level modelling is the scope of this paper, and an outline of a method for developing a C2S model is described in greater detail. Aspects represented in our object oriented approach are given. Finally, experiments employed to relate C2S effectiveness to operational consequences are described. The role of scenarios and use of war games and scenario discussions are central topics in this context. The study is currently in its initial phases and the approach presented in this paper is still under development.
Author
Command And Control; Mathematical Models; Computerized Simulation; Cost Effectiveness; Warfare

20000032369 Industrieanlagen-Betriebsgesellschaft m.b.H., Command, Control, Communications and Intelligence Div., Ottobrunn, Germany
ON A MODULAR CONCEPT FOR COMMAND AND CONTROL IN SIMULATION MODELS
Dompke, Uwe K. J., Industrieanlagen-Betriebsgesellschaft m.b.H., Germany; Tolk, Andreas, Industrieanlagen-Betriebsgesellschaft m.b.H., Germany; Modelling and Analysis of Command and Control; June 1999, pp. 9-1 - 9-5; In English; See also 20000032361; Copyright Waived; Avail: CASI; A01, Hardcopy; A03, Microfiche

This paper describes a principle architecture for the modelling of command and control in simulation systems. It focus on the definition of modules to represent command and control, reconnaissance and communications independent from an actual command level. Hereby, command and control, reconnaissance, communications and effective entities - i.e., atomic elements within the simulation systems modelling the objects that act, interact, move and are victim of attrition - are clearly divided and grouped within respective modules. The communications module builds within this the interfaces connecting all other elements.
Author
Command And Control; Mathematical Models; Computerized Simulation

20000032370 Danish Defence Research Establishment, Copenhagen, Denmark
A META-LANGUAGE FOR SPECIFYING THE COMMAND AND CONTROL PROCESSES
Simonsen, K. J., Danish Defence Research Establishment, Denmark; Modelling and Analysis of Command and Control; June 1999, pp. 10-1 - 10-18; In English; See also 20000032361; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

This paper will give a general description of the basic ideas, concepts and the methodology chosen to design and implement a meta-language for specifying the ordering of force units including a suitable representation of the Command, Control, Communications and Information (C3I) processes, which forms the basis for the ordering of forces. The meta-language presented here has been incorporated in the land combat model JOHANNES developed at Danish Defence Research Establishment (DDRE). The name Ordrogram Language is used to designate any meta-language used for specifying the ordering of force units. This specification for each force unit is called the Ordrogram for that unit. So in other words, this paper will give a general description of the Ordrogram Language implemented in the JOHANNES model. Furthermore, some illustrative results will given in order to show some of the capabilities of the JOHANNES model. From a study on different options for the set of longer range intelligence gathering systems the time when a major critical decision was taken and the total losses to own forces for the different options will be presented.
Author
Command And Control; Object-Oriented Programming; Communication; Information; Combat; Programming Languages

20000032371 Centre d'Analyse de Defense, Arcueil, France
REPRESENTATION OF C3I IN AN OBJECT-ORIENTED SIMULATION ENVIRONMENT *[REPRESENTATION DU C3R DANS UN ENVIRONNEMENT DE SIMULATION ORIENTE OBJET]*
Larrieu, M. L., Centre d'Analyse de Defense, France; Modelling and Analysis of Command and Control; June 1999, pp. 11-1 - 11-8; In French; See also 20000032361; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

CAD (Defense Analysis Center) is an organization within the French Defense Ministry which is responsible for conducting technical operational studies for governmental bodies. In order to best realize this type of study, CAD has developed numerous tools, including a reception structure allowing for research and development of technical operational simulations. The goal of this presentation is to describe the methodology developed by CAD in order to take into account the C3I aspect (Communication, Control, Commands, Information) in this type of simulation. In this article, the environment used by CAD, ESCADRE, as well as the BABYLONE library including reusable software components developed by this center, are presented. Next, C3I modeling in BABYLONE is described in detail. Finally, a study example carried out by CAD, involving the intervention of a complex communication network is presented.
Author
Computer Programs; Computer Techniques; Command And Control; Information; Mathematical Models

20000032372 MATRA Systemes and Information, Velizy-Villacoublay, France
USING COMMAND AGENTS FOR MILITARY PLANNING
Bouche, Jean-Paul, MATRA Systemes and Information, France; Floch, Jean-Pierre, Thomson-CSF Detexis, France; Michel, Martine, SYSECA, France; Modelling and Analysis of Command and Control; June 1999, pp. 12-1 - 12-8; In English; See also 20000032361; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

The main objective of the CARNEADE (Digitized Air Land Battle for Analysis Training and Decision-making) project is to meet the various needs of the French Army and the DGA (the French acquisition directorate of the Ministry of Defense) in the following areas: Training of Headquarter staffs at Brigade level and above, Operational decision support, and Force System analysis, For this main objective, the CARNEADE project consists in the development of a family of tools based on a common air-land battle simulation kernel. Sizing own forces and improving Courses Of Action (COA) are complex issues in the combat operations preparation. This paper presents the functional and technical approaches used in the Army Operational Planning Demonstrator (DPO) to provide staff officers with an effective framework for military planning. The corner stone of this development is the use of Command Agents (CA) modeling the division, regiment and company commanders decision-making processes. The friendly and enemy division CAs elaborate separate Courses Of Action and those COA's are then played one after another in the combat simulation system. The simulation results are finally used by the military staff to evaluate and compare the friendly COA's. This paper presents the various techniques used for military knowledge representations of tactics, tasks and missions at the different Army echelons. Issues related to Flexibility and effectiveness of planning services are examined and then problems associated with Command Agents, such as knowledge management and VV&A, are addressed. Finally lessons learned for future developments of the program are considered.
Author
Military Operations; Command And Control; Decision Making; Mathematical Models; Mission Planning

20000032373 Electronic Systems Center, Modeling, Simulation and Training Product Area Directorate, Hanscom AFB, MA USA
INTEGRATING OPERATIONAL AND SYSTEMS ARCHITECTURES: HOW MODELING AND SIMULATION CAN EMPOWER COMMAND AND CONTROL ACQUISITION
Gibson, Richard B., Electronic Systems Center, USA; Modelling and Analysis of Command and Control; June 1999, pp. 13-1 - 13-8; In English; See also 20000032361; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

Both users and developers in the Air Force command and control (C2) community believe that the only way to improve C2 is to acquire and manage it as an integrated weapon system. Building components and hoping the end-user will lash them together correctly is a guarantee for disaster-that is not how we procure and deliver F-22s or M-1A1s. The immediate question about an integrated C2 weapon system is how do we do it? How do we even visualize a single system composed of hundreds or thousands of human beings and workstations and possibly stretching across multiple time zones, out into space and down into the cockpit and foxhole? How do we know the best approaches to improve our operational performance across the spectrum of military operations without this visualization? How do we know the best way to integrate technological innovation into our command and control capabilities? How can we trade different proposals to improve our performance in any meaningful or quantifiable way? The answers depend on perceiving a C2 architecture in at least three complementary ways, and in using processes and modeling and simulation (M&S) tools to integrate these perceptions and the different communities that create and use them. For too long, the acquisition community has built C2 capabilities as if they were end-items. The end result of such behavior is the example in December 1994 when NATO decided to create a Combined Air Operations Center in Vicenza, Italy to manage the air campaign over Bosnia. The US Air Force, as part of a NATO multi-force effort, promptly shipped tons of equipment to Vicenza. The NATO operators on site then faced a problem roughly analogous to what a fighter squadron would face if it received boxes and boxes of F-16 components and had to build its complement of aircraft then and there. The analogy of a C2 system to an F-16 bears up under further scrutiny: An F-16 is composed of thousands of components and subsystems, many of which are built in different locations by different vendors. These components may never come into contact until the assembly line, but they are expected to mesh together and interoperate as a single integrated system within narrow tolerances and without fault. Likewise, the acquisition community and industry will continue to build C2 components individually, but they must adopt practices that ensure that these components are integrable and interoperable when combined into the single weapon system. This is old ground that others have plowed and replowed thoroughly. The solution to the problem of interoperability that the USA Department of Defense has adopted is to build components in compliance with the Joint Technical Architecture, or JTA, and in compliance with a particular instantiation of the JTA called the Defense Information Infrastructure--Common Operating Environment, or DII-COE. Capabilities so built should be able to reside on the same workstation as other capabilities, share data and use common tools and services. The ultimate goal is for capabilities currently residing on separate workstations to eventually evolve into icons and applications residing on the same or compatible workstations. Given that the Air Force is building all Of its C2 equipment in compliance with the JTA and DII-COE, have we thereby solved all of our problems? No, because building completely modular components without a blueprint will not guarantee that putting all the modules together will produce anything in particular, e.g., an airplane that will fly or a rocket that will launch. A technical architecture is just one way of looking at an integrated system, and is by itself insufficient to characterize that system. At least two more architectural views exist, the systems architecture and the operational architecture. The Office of the Assistant Secretary of Defense for Command, Control, Communications and Intelligence (OASD/C3I) released version 2.0 of the C4ISR Common Architecture Framework, which defines these three aspects of a command and control architecture and their interrelationships. Having introduced the technical architecture above, we shall discuss the other two in turn. Author

Systems Engineering; Command And Control; Computerized Simulation; Mathematical Models; System Effectiveness

20000032374 Evidence Based Research, Inc., Vienna, VA USA
MODELING DECISION EXPERTISE FOR C2 ANALYSES
Noble, David F., Evidence Based Research, Inc., USA; Hayes, Richard E., Evidence Based Research, Inc., USA; Deutsch, Robert D., Evidence Based Research, Inc., USA; Modelling and Analysis of Command and Control; June 1999, pp. 14-1 - 14-10; In English; See also 20000032361; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

Human decision making is central to command and control (C2), and decision quality can significantly impact C2 effectiveness and the achievement of military objectives. Unfortunately, however, the immaturity of decision making models impedes studies in which decision quality is an important factor affecting C2 and mission effectiveness. This paper outlines a methodology for modeling decision quality and timeliness within C2 simulations. It estimates the correctness and timeliness of decisions given the quality of the decision maker's situation picture and his level of expertise, as modified by performance factors such as stress and fatigue, by experience, and by decision support systems. The models employed in this methodology are based on cognitive theories of expertise. This methodology focuses on contingent decision problems in which the decision maker must choose between previously specified alternatives, where policy and doctrine for making the choice are clear, but where the applicability of the policy to the current situation may be obscure. That is, the alternative that should be selected is clear if the situation can be understood correctly, but this understanding may be very difficult. We are not modeling the more complex decision making requiring planning and identification of alternatives. Derived from text

Command And Control; Decision Making; Mathematical Models; Expert Systems

20000032375 Physics and Electronics Lab. TNO, The Hague, Netherlands
TACTICAL INFORMATION ABSTRACTION FRAMEWORK IN MARITIME COMMAND AND CONTROL
Treurniet, Willem, Physics and Electronics Lab. TNO, Netherlands; vanDelft, Jan, Institute for Human Factors TNO, Netherlands; Paradis, Stephane, Defence Research Establishment Valcartier, Canada; Modelling and Analysis of Command and Control; June 1999, pp. 15-1 - 15-15; In English; See also 20000032361; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

Various operational trends in naval warfare put the shipboard decision making process under pressure. As an example, there is a continuous advance in threat technology and an ongoing shift to crisis management scenario's in littoral waters. Data must be processed under time-critical conditions and, as a consequence, the risk of saturation in building a tactical picture increases. In this complex context, the decision-makers need to gain a cognitive awareness of what is going on in their environment, by constructing a hierarchical situation model of this environment. This situation model consists of the basic elements present in the environment, relevant for understanding the situation. Furthermore, this situation model consists of combinations of interrelated elements, spatial and temporal structures, and abstractions expressing the situation at a functional and intentional level. Given our problem domain, maritime command and control, we will call this language according to which the situation model can be structured Tactical Information Abstraction Framework (TIAF). The purpose of this paper is to derive and describe a maritime TIAF. This TIAF can be used as a language in which the result of data fusion can be expressed. If we are able to use a TIAF, according to which situation awareness can be structured, in the data fusion process, we can make a smooth match of this process with a situation awareness framework. Thus we will be able to integrate the human element into the design of a decision support

system aiding the operators to achieve the appropriate situation awareness.
Author
Command And Control; Decision Making; Man Machine Systems; Real Time Operation; Decision Support Systems; Information Systems

20000032376 National Defence Coll., Dept. of Operational Studies, Stockholm, Sweden
MISSION EFFICIENCY ANALYSIS OF TACTICAL JOINT COGNITIVE SYSTEMS
Worm, Arne, National Defence Coll., Sweden; Modelling and Analysis of Command and Control; June 1999, pp. 16-1 - 16-13; In English; See also 20000032361; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

It is imperative that effective C3I in military operations ensures that a sufficient amount of information reaches the intended decision-maker in time, and that the information management system sustains the execution of a mission without excessive delay and friction. Information and intelligence must fulfil stringent requirements of reliability, availability, relevance, and diagnosticity. One of many purposes of tactical integrated C3I systems is to secure an omnidirectional, continuous flow of information from the division level down to the platoon and squad levels. Sometimes even individual soldiers and sensor systems must without delay be allowed to affect the decisions and actions of a higher-echelon commander. The main objective for our research undertaking is to actively take part in the fulfilment of the needs mentioned above, and thereby also contribute to the field of C3I system design, assessment and evaluation. In this paper we outline our work on development of theories and models for acquisition, processing and representation of safety- and time-critical information, intended to aid decision makers performing complex tactical operations. We also tested these concepts in several simulated tactical operations, and finally, validated the concepts in a number of full-scale exercises. Our contention is that integrating relevant and effective methods and tools for analysis, synthesis and development is of the utmost importance to achieve successful improvement of command and control procedures as well as to successfully design and operate future command and control systems.
Derived from text
Command And Control; Cognition; Communication; Intelligence; Military Operations; Information Management; Decision Making

20000032377 Evidence Based Research, Inc., Vienna, VA USA
A COMMAND AND CONTROL OPERATIONAL ARCHITECTURE FOR FUTURE WARFIGHTERS
Wheatley, Gary, Evidence Based Research, Inc., USA; Noble, David F., Evidence Based Research, Inc., USA; Modelling and Analysis of Command and Control; June 1999, pp. 17-1 - 17-19; In English; See also 20000032361; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

Command and control architectures provide the frameworks to design, develop, and build the C2 systems capable of greatly increasing the effectiveness of military forces. In the USA, there are three classes of architectures involved. These were developed by the US Army Science Board and accepted by the US Defense Science Board and are consistent with generally accepted architecture design criteria, namely, Technical Architecture (the equivalent of building standards), Systems Architecture (the systems engineering), and Operational Architecture (the operational concept and connectivities that determine how the system will be used). This paper focuses entirely on the Operational Architecture, and uses an analytical approach to decompose it in terms of concept, structure, connectivity and activity.
Derived from text
Architecture (Computers); Command And Control; Design Analysis; Systems Engineering; Defense Program

20000032378 Marmara Research Inst., Information Technologies Research Inst., Gebze, Turkey
QUALITY CRITERIA FOR USER/SYSTEM INTERFACES
Oren, Tuncer I., Marmara Research Inst., Turkey; Cetin, Selim, Marmara Research Inst., Turkey; Modelling and Analysis of Command and Control; June 1999, pp. 18-1 - 18-8; In English; See also 20000032361; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

User/system interfaces are essential components of any interactive software, including command and control software. As part of overall quality of any interactive software quality issues of interfaces are very important. A set of 27 interface quality criteria for user/system interfaces are presented in four groups which are convenience (usability), communicativeness, reliability, and evolvability. The convenience criteria are related with: conveniences of the language, terminology, metaphor and the inputs; and functionality, simplicity, consistency, minimum memory load, navigability and least training. Communicativeness criteria cover: informativeness, guidance, perceptiveness, explanation ability, expressiveness, esthetic/cultural acceptance and types of user/system relationship. Reliability criteria are concerned with: error prevention, error tolerance, caution, predictability and access reliability. Evolvability criteria cover: adaptability, customizability, learning ability, maintainability and portability. The criteria can be used for evaluation and comparison of existing interfaces as well as for the design and implementation of new ones. Four tables with appropriate questions are provided to systematize the evaluations.
Author
Human-Computer Interface; Command And Control; Computer Programs

20000032379 Defence Evaluation Research Agency, Centre for Defence Analysis, Farnborough, UK
ICS/ISTAR BALANCE OF INVESTMENT METHODS STUDY
Sharp, Lynda, Defence Evaluation Research Agency, UK; Bateman, Alison, Defence Evaluation Research Agency, UK; Modelling and Analysis of Command and Control; June 1999, pp. 19-1 - 19-7; In English; See also 20000032361; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

The Centre for Defence Analysis (CDA) within DERA are currently developing a top-down approach to Balance of Investment (BoI) in ICS (Information and Communication Systems) and ISTAR (Intelligence Surveillance Target Acquisition and Reconnaissance) systems. The method aims to assess the benefits of investment in battlefield ICS and ISTAR capabilities and to meet the need for investment in ICS systems to be evaluated alongside weapon systems using the same high level measures of effectiveness. The method also provides insight into the nature and levels of ICS and ISTAR capabilities needed to support planned future concepts of operation. An approach has been developed which is based around the use of constructive simulation models of theatre level warfare. An important part of the method involves identifying the key information flows which would occur during a campaign. The method enables: (a) identification of the ICS and ISTAR capabilities needed to support planned future concepts of operations; (b) comparison of these with existing and planned procurement; (c) identification of excesses or shortfalls; and (d) measurement of the effect of any shortfalls on the conduct and outcome of an operation. In addition, to contribute fully to the balance of investment debate, the methodology should ideally be able to assess the balance of investment across the full spectrum of land, air and maritime warfare, including joint and combined operations, from a tactical to strategic level.
Derived from text
Information Systems; Communication; Information Flow; Command And Control; Intelligence

20000032380 TRADOC Test and Experimentation Command, Fort Bliss, TX USA
DIGITIZATION AND THE ANALYSIS PROCESS, LESSONS FROM THE ASSESSMENT OF THE U.S. ARMY'S TASK FORCE 21
Dzierzanowski, Kenneth, TRADOC Test and Experimentation Command, USA; Modelling and Analysis of Command and Control; June 1999, pp. 20-1 - 20-13; In English; See also 20000032361; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

In March 1997, the U.S. Army executed one of the most complex experiments in the history of land warfare. Utilizing thousands of pieces of advanced equipment and nearly ten thousand soldiers, evaluators, civilian employees, and contractors, the U.S. Army glimpsed the potential garnered from information age technologies. The experiment was conducted in the vastness of the National Training Center (NTC), Fort Irwin, California, on Army installations such as Fort Hood, Texas, and in analytical agencies such as the

U.S. Army's Training and Doctrine Command (TRADOC) Analysis Center (TRAC), White Sands Missile Range (WSMR), New Mexico. This paper develops the process, models, and lessons learned from the support of the Task Force 21 (TF-21) Advanced Warfighting Experiment (AWE). First, the TF-21 AWE process is examined with a review of terms, the hypothesis definition process, AWE objectives, information systems, key participants, and experiment initiatives. Next the reader is given an overview of the assessment process that followed the Model-Experiment- Model (MEM) methodology. The MEM discussion details how to replicate field exercises with increased fidelity, limitations, models used, MOEs/MOPs, and 'digitizing' the scenarios. Finally, detailed analysis, with models such as Janus and the Combined Arms and Support Task Force Evaluation Model (CASTFOREM), is conducted with results. The paper is concluded by a review of lessons learned and how these lessons will benefit military decision making.
Derived from text
Information Systems; Decision Making; Warfare; Decision Support Systems; Military Operations

20000032381 Physics and Electronics Lab. TNO, The Hague, Netherlands
EVALUATION OF BATTLEFIELD MANAGEMENT SYSTEMS
Spaans, Mink, Physics and Electronics Lab. TNO, Netherlands; Modelling and Analysis of Command and Control; June 1999, pp. 21-1 - 21-16; In English; See also 20000032361; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

TNO is a modem Dutch, knowledge-based organisation providing services in the form of research, development and application of new technologies. TNO's knowledge finds immediate and practical use for all clients, both large and small, in the Netherlands and around the world. TNO provides most Dutch government departments with support in formulating policy, and undertakes projects to ensure that the policy works. The Dutch armed forces use the wide range of TNO services and the TNO defence research institutes are even referred to casually as the ministry of defence's in-house laboratory. Battlefield Management Systems (BMS) is one of the programs TNO is involved in. A BMS aims at reaching an optimal situation awareness while striving for maximal combat power, safety and endurance. Situation awareness can be defined as awareness of the current role and status related to friendly, enemy and neutral troops within the relevant part of the operational area. Situation awareness plays a major role in all decision processes. The first phase of the Dutch Battlefield Management Research and Development program started in 1996 when the Royal Netherlands Army (RNLA) awarded TNO a contract to investigate the phenomenon BMS. The attention for BMS was coupled to the introduction of a new German-Dutch Reconnaissance Vehicle in 2001 (The Fennek). Although this platform will most likely be the first one with a fully integrated BMS, the BMS-study is not limited to this platform. The ultimate goal is that all operational units in the RNLA, starting with the reconnaissance, will have a BMS. Among other things, the first phase led to a global list of functionality's and an identification of relevant developments in the international defence community. One of the outcomes of this study was the TNO- advise to evaluate a number of commercially available BMS'S. It was advised by T'NO to evaluate the systems in a laboratory environment. The purpose of this evaluation was twofold: first of all it would have to assess the systems as a possible solution for a Dutch BMS; secondly, the evaluation would help to refine the requirements of the BMS obtained in the first phase.
Derived from text
Command And Control; Armed Forces; Combat; Information Systems; Management Systems

20000032383 TRADOC Analysis Command, White Sands Missile Range, NM USA
CODE OF BEST PRACTICE FOR THE ASSESSMENT OF COMMAND AND CONTROL
Bennett, Robert, TRADOC Analysis Command, USA; Modelling and Analysis of Command and Control; June 1999, pp. 23-1 - 23-13; In English; See also 20000032361; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

Code of best practice for the assessment of C2 represents over 3 years of team effort and evolved from a series of workshops. It summarizes current state-of-the-art for conducting evaluation and modeling of command and control. It is intended for experienced or analysts with no prior experience in C2 analysis as well as for broad dissemination. The paper contains the following sections: Introduction, Overview and summary of key points; Human factors and organisational issues, Scenarios, Measures of merit; Tools (models) and their application; and Conclusion and recommendations.
CASI
Command And Control; Human Factors Engineering

20000032384 Ministry of Defence, London, UK
THE FIVE AGES OF C3 MODELLING: A PRESENTATION TO THE NATO SAS-002 WG
Grainger, P. L., Ministry of Defence, UK; Modelling and Analysis of Command and Control; June 1999, pp. 24-1 - 24-8; In English; See also 20000032361; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

A presentation to the NATO SAS-002 WG on the Five Ages of C3 Modelling is summerized. The paper contains the 13-slides (with their description) used in the presentation. The five ages are: (1) The golden age lasted from about 1938 to 1945, and is a bit of a cheat, since there were hardly any computers then, and no computer models. However, it is well worth including here since it still has a lot to tell us. It also represents a sort of gold standard against which to judge how far we have progressed since (mostly backwards until recently) (2) The dark ages which lasted from about 1945 to 1975, during this period computer models appeared in profusion, the majority of them deterministic models based on the use of Lanchester equations to represent what in reality would be much more complex tactical interactions. The Dark Ages saw an unhealthy separation, still with us, between the 'C3 specialists', who concentrated typically on radar and communications in rather narrowly defined problem domains which they felt able to tackle, and the OR modellers, who had the wider perspective to address issues at the operational or strategic level, but lacked effective ways of doing so. C3 was simply ignored, or implicitly assumed to work perfectly, and as a result the models usually generated grossly optimistic effectiveness estimates and far too high attrition rates. (3) The renaissance which lasted from about 1975 to 1990. In this period it was increasingly realised just how much C3 mattered, particularly how essential solving the C3 modelling problem was for justifying new C3 hardware to the bean- counters. Faltering attempts were made to represent C3 aspects in models, but often as add-ons to existing model architectures, and often using 'quick fixes' like expert systems, which didn't really work. UK models like GenKnoFlexE and IMAGE, and analogous models run by other nations, had rule-bases comprising tens of thousands of rules which were so complex that the models became impossible to understand, a problem compounded by the inconvenient tendency towards chaotic behaviour in deterministic models. (4) The enlightenment lasting from about 1990 to 2001. By now we have analysed the problem quite well, and have invested in the fundamental re-thinking required to stand some chance of getting a solution. It is surprising it has taken so long, since the result is simply a common-sense description of how information flows around the C3 system and what happens to it on the way. We have learned that C3 aspects must drive the structure of any or model, which explains why previous attempts to graft it on to existing models largely failed. We have also homed in on the principal technical problems: data fusion and planning. Though we are making visible and very encouraging progress, these problems have not yet been solved, and it may be optimistic to expect enlightenment to be achieved by 2001. (5) The age of realism, at the start of the 5th period, in 2001, we will hopefully have achieved the following: confidence that or model results fairly reflect the influence of C3 aspects; the ability for the first time to carry out cost-effectiveness trade-offs between C3 systems (including ISTAR and communications systems), platforms and weapons; the ability for the first time to explore tricky issues which have so far been completely beyond our grasp, such as alternative command styles and rules of engagement; and as a bonus, we should have considerably speeded up the scenario development process, simply by applying force deployment logic such as genetic algorithms to the start of conflict.
CASI
Command And Control; Communication; Computerized Simulation; Mathematical Models; Histories

20000032385 Metron, Inc., Solana Beach, CA USA
REPRESENTATION OF COMMAND AND CONTROL (C2) AND INFORMATION OPERATIONS (IO) IN MILITARY SIMULATIONS

Stevens, William K., Metron, Inc., USA; Decker, William L., Metron, Inc., USA; Gagnon, Colleen M., Metron, Inc., USA; Modelling and Analysis of Command and Control; June 1999, pp. 25-1 - 25-16; In English; See also 20000032361
Contract(s)/Grant(s): N00014-95-C-2037; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

The representation of command and control (C2) and command decision processes, through the use of modeling and simulation (M&S) techniques has become a key element of Department of Defense (DoD) technology initiatives in the areas of analysis and acquisition, operations planning and execution, and training. It has become increasingly apparent that if DoD sponsored military simulations are to effectively represent the entire battle space, it is imperative that they accurately simulate C2 and related command decision activities as well as the impact that deep sensors, communications, and information flows have on these processes. The closely related issues of accurately representing information operations (IO) and command and control warfare (C2W) are also becoming increasingly prominent within the DoD analysis, operational, and training communities. The purpose of this paper is to discuss recent advances in modeling and simulation practice which specifically address the representation of C2, IO, and C2W processes. More specifically, this paper describes the command and control (C2), information operations (IO), and C2 warfare (C2W) representations implemented within the Naval Simulation System (NSS).
Author
Command And Control; Information Systems; Warfare; Computerized Simulation; Mathematical Models; Communication

20000032386 Mitre Corp., McLean, VA USA
CO-EVOLVING C2 ORGANIZATIONAL PROCESSES, DECISION SUPPORT TECHNOLOGY, AND EDUCATION/TRAINING: THE ROLE OF EVALUATION IN COGNITION SYSTEMS ENGINEERING
Ehrhart, Lee Scott, Mitre Corp., USA; Bigbee, Anthony J., Mitre Corp., USA; Modelling and Analysis of Command and Control; June 1999, pp. 26-1 - 26-17; In English; See also 20000032361; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

Advances in simulation environments and AAR support present opportunities to provide robust feedback on technology-supported decision making processes, as well as the combat effectiveness of those decisions. To realize these possibilities, research and development efforts must focus on innovative methods to capture decision process and use analysis of relationships between decision-making process and technology to support system design evolution. For example, what are effective ways to represent and understand process control in a simulated environment with autonomous entities'? How do we select the right concept and simulation abstraction for training future decision makers' This paper presents a conceptual model of a C2 decision system that comprises the command and control organizational functions, tasks, and processes. This metamodel integrates multiple models, including user profiles, decision and functional task models, organizational models (goal hierarchies, control structures, processes, and functions), hardware, software and communication architectures, information models (data structures, and information flow), human-computer interaction models (information presentation and interaction models, and collaboration models). Throughout this paper, we discussed the factors that determine the effectiveness of information technology in supporting the C2 decision system in situation assessment, COA evaluation and selection, and the synchronization of execution. System developers must support decision process capture and analysis to help organizations learn - through discovery-based learning or in training via execution practice. The conceptual model for training and exercise support systems should include an AAR process model that incorporates the instructional objectives and subsequent cognitive requirements in order to drive technology requirements. The complex interactions between the human, machine, and communication components that define C2 decision systems require the synthesis of multiple model types. Our next steps will look at how simulations and the conceptual models that link simulations to C2 decision support systems may best support the multiple goals of system development, organizational process evolution, and discovery learning. The goal of this research is the design of a sufficiently robust framework to guide construction of models that will the exploration and evolution of C2 systems, including: # Analyses of requirements (system objectives, functions, tasks, operational capabilities); # Evaluations of performance and effectiveness characteristics (current and potential); # Exploration of the impacts of new technology on organizational processes; and # Indications of the training and education required to achieve desired results.
Derived from text
Command And Control; Decision Support Systems; Information Systems; Mathematical Models; Decision Making; Computer Programs; Systems Analysis

20000032387 Mitre Corp., McLean, VA USA
MAJOR CHALLENGES POSED BY FUTURE C2 ASSESSMENTS
Starr, Stuart H., Mitre Corp., USA; Modelling and Analysis of Command and Control; June 1999, pp. 27-1 - 27-12; In English; See also 20000032361; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

This paper looks ten years into the future to identify and characterize the major challenges that assessors of Command and Control (C2) will have to confront. As a context for that assessment, a trend analysis is performed of the factors that are perceived to have the greatest impact on future C2 assessment needs. Using a variant of the framework developed in the NATO Code of Best Practice (COBP) for C2 Assessment, the results of the trend analysis are aggregated to identify and characterize major challenges posed by future C2 assessments.
Author
Command And Control; Trend Analysis; Computer Techniques; Decision Support Systems

20000033631 Research and Technology Organization, Systems Concepts and Integration Panel, Neuilly-sur-Seine, France
ELECTRONIC WARFARE TEST AND EVALUATION, VOLUME 17, FLIGHT TEST TECHNIQUES SERIES *[LES ESSAIS ET L'EVALUATION DU MATERIEL DE GUERRE ELECTRONIQUE]*
Banks, H., Editor, Research and Technology Organization, France; McQuillan, R., Editor, Research and Technology Organization, France; March 2000; 91p; In English
Report No.(s): RTO-AG-300-Vol-17; AC/323(SCI)TP/24; ISBN 92-837-1034-7; Copyright Waived; Avail: CASI; A05, Hardcopy; A01, Microfiche; C01, CD-ROM

The past decade has seen an enormous increase in the use and importance of the 'electronic battlefield.' As a result of the continuing growth in this area, this volume has been prepared to serve as an introductory reference to the process of testing and evaluating Electronic Warfare Systems. Electronic Warfare (EW) is the mission area responsible for establishing and maintaining a favorable position in the electromagnetic domain. Test and evaluation (T&E) of those devices used on modem military aircraft to prosecute this critical mission area requires the use of a wide range of test techniques and analytical methods to assure users of the readiness of EW systems to meet the challenges of the combat environment. Actual in-flight testing comprises a relatively small portion of the EW T&E process. Today's tester makes judicious use of a plethora of models, simulations, and hardware-in-the-loop test facilities prior to and during the more realistic open-air range and installed system test facility events. Analysis of data derived from each of these test opportunities leads to the overall evaluation of the EW system. This volume will introduce the concept of the EW Test Process and subsequently show how it is applied in each class of test facility and to each major division of EW systems. The reader will find that the concentration in this document is far broader than 'flight test' - ranging from laboratory efforts to establish the system performance baseline through complex ground-based simulations and finally the limited, but vitally important, verification accomplished in the open air range environment.
Author
Hardware-In-The-Loop Simulation; Computerized Simulation; Electronic Warfare; Flight Tests; Performance Tests

20000037832 Marconi Communications S.p.A., Defence Communications Div., Genoa, Italy
ADVANCES IN UAV DATA LINKS: ANALYSIS OF REQUIREMENT EVOLUTION AND IMPLICATIONS ON FUTURE EQUIPMENT
Baiotti, S., Marconi Communications S.p.A., Italy; Scazzola, G. L.,

Marconi Communications S.p.A., Italy; Battaini, G., Marconi Communications S.p.A., Italy; Crovari, E., Marconi Communications S.p.A., Italy; Advances in Vehicle Systems Concepts and Integration; April 2000, pp. B10-1 - B10-13; In English; See also 20000037804; Copyright Waived; Avail: CASI; A03, Hardcopy

This paper resumes the fundamental operational requirements that a UAV must accomplish to be effectively performant in a military and civil environment. Moving from these considerations, a list of technical requirements for Data Link systems to be employed is derived and a suitable Data Link architecture, based on the evolution of current Marconi's J-Band Data Link for CATRIN-SORAO programme is presented.
Author
Data Links; Pilotless Aircraft; Military Technology

20000037833 California Univ., Dept. of Electrical and Computer Engineering, Irvine, CA USA
SIGNAL PROCESSING FOR MICRO INERTIAL SENSORS
Stubberud, Allen R., California Univ., USA; Yu, Xiao-Hua, California Univ., USA; Advances in Vehicle Systems Concepts and Integration; April 2000, pp. B11-1 - B11-7; In English; See also 20000037804; Copyright Waived; Avail: CASI; A02, Hardcopy

In the development of the guidance and control packages for unmanned vehicles, it is highly desirable to have inertial measurement sensors which are small, inexpensive, low power, reliable and accurate new technological advances in the design and construction of micro inertial sensors, such as accelerometers and gyroscopes. have much promise in providing small, inexpensive, and low power devices; however, much improvement in the reliability and, especially. the accuracy of these micro devices is still necessary Further major improvements in these two properties will probably not be accomplished in the near future, thus it will be necessary to use special signal processing methods to provide the accuracy One way which has been proposed to improve the accuracy, and concurrently the reliability. of micro sensors is to use many. perhaps one hundred or more, micro sensors on a single chip (or a few chips) and using statistical methods to combine the individual outputs of these sensors to provide an accurate measurement One method of performing such a combination is through an extended Kalman filter (EKF). A standard application of an EKF to an array of gyroscopes would involve at least six state equations per gyroscope and the number of covariance equations would be in the order of the square of the product of six times the number of gyroscopes Obviously, the curse of dimensionality very quickly limits the number of sensors (gyroscopes) which can be used Even if the EKF for each individual gyroscope is uncoupled from the rest. the number of covariance equations is of the order of the number of gyroscopes times six squared This can still lead to a formidable computational burden In this paper, a new technique of applying an EKF to this problem of combining many sensors is proposed. By using the common nominal model for each of the micro sensors and developing a single EKF. improved accuracy is achieved by a single EKF with the dimension of one sensor. For cases in which the micro sensors are corrupted by correlated noise (between the sensors) an artificial neural network could be added to the EKF dynamics to track the noise. Simulated examples will be discussed.
Author
Signal Processing; Inertial Platforms; Microelectromechanical Systems

20000037834 Office of Naval Research, Arlington, VA USA
DISTRIBUTED INTELLIGENCE, SENSING, AND CONTROL FOR FULLY AUTONOMOUS AGENTS
Moshfegh, Allen, Office of Naval Research, USA; Siegel, David S., Office of Naval Research, USA; Advances in Vehicle Systems Concepts and Integration; April 2000, pp. B12-1 - B12-9; In English; See also 20000037804; Copyright Waived; Avail: CASI; A02, Hardcopy

Future naval missions at sea or shore will require effective and intelligent utilization of real-time information and sensory data to assess unpredictable situations, identify and track hostile targets, make rapid decisions, and robustly influence, control, and monitor various aspects of the theater of operation. Littoral missions and operations are expected to be highly dynamic and extremely uncertain. Communication interruption and delay are likely, and active deception and jamming are anticipated. There is an evolving need for a new generation of unmanned aerial vehicles (UAVs) to perform the tasks traditionally attributed to manned aircraft. For example, UAVs such as Global Hawk are rapidly becoming integral part of military surveillance and reconnaissance operations. UAVs are economical, capable of carrying powerful sensors, and complement manned aircraft missions. Other inherent advantages are (a) removal of personnel from hazardous environments; (b) elimination of error-prone repetitive tasks; (c) reduction of cost associated with operational safety and training; (d) expansion of operational envelope; and (e) performing long endurance mission. Recent advances in high speed computing, information processing, sensors, wireless communications, Internet technologies, and mobile telecommunications have led to emergence of network-centric systems. The technology focus is shifting from individual platforms with limited number of agents to multiple platforms with transparent agents. The software and hardware agents are becoming smarter and capable of continuously adapting to changes in the operational environment. The agents can strategize and make decisions to achieve the desired objectives of mission. At the Office of Naval Research (ONR) we envision airborne intelligent autonomous agents will have the ability to collect, process, fuse, and disseminate real- time information while exploiting and/or denying an enemy similar opportunities. These airborne intelligent autonomous agents are referred to as unmanned combat the notion of network-centric warfare. It is well understood that network-centric operations can deliver to the US military a distinct edge over the enemy. At the strategic level it provides, not simply raw data but a detailed understanding and situational awareness of the appropriate competitive space. At the tactical level, network-centric warfare allows forces to develop rapid response capability and the ability to command and control the littoral environment in real-time settings.
Derived from text
Autonomy; Distributed Parameter Systems; Pilotless Aircraft; Control Theory; Artificial Intelligence

20000037835 Bundesamt fuer Wehrtechnik und Beschaffung, Koblenz, Germany
COMMAND AND CONTROL SYSTEM OF UNMANNED SURFACE DRONES FOR SEA MINE DISPOSAL: THE AUTOMATION OF MINESWEEPING OPERATIONS BY MEANS OF THE COMMAND AND CONTROL SYSTEM (C EXP 2 SYSTEM) FOR THE REMOTE-CONTROLLED MINE COUNTERMEASURES SYSTEM TROIKA
Brueckner, Gunther, Bundesamt fuer Wehrtechnik und Beschaffung, Germany; Advances in Vehicle Systems Concepts and Integration; April 2000, pp. B13-1 - B13-9; In English; See also 20000037804; Copyright Waived; Avail: CASI; A02, Hardcopy

The following presentation gives an overview about the concept and the capabilities of the new command and control system for remote controlled unmanned surface drones which will be used for disposal of seamines. The presentations shows that a reasonable automation of minesweeping operations with unmanned drones under heterogeneous operating conditions is possible and will improve the sweeping performance significantly.
Derived from text
Command And Control; Drone Vehicles; Remote Control; Countermeasures; Seas; Mines

20000037839 Thomson-CSF Detexis, Elancourt, France
CRECUS: A RADAR SENSOR FOR BATTLEFIELD SURVEILLANCE UAVS
Boucard, H., Thomson-CSF Detexis, France; Gach, T., Thomson-CSF Detexis, France; Sicsik-Pare, E., SPOT/ST/OER, France; Advances in Vehicle Systems Concepts and Integration; April 2000, pp. B19-1 - B19-11; In English; See also 20000037804; Copyright Waived; Avail: CASI; A03, Hardcopy

The paper describes a SAR/MTI radar sensor for Air-to- Ground Surveillance UAVs designed as a slow-flying, medium-altitude UAV payload. We present experimental results and emphasize salient conclusions obtained following the developmental flight test phase.
Derived from text
Moving Target Indicators; Radar Detection; Surveillance; Pilotless Aircraft; Synthetic Aperture Radar

20000037890 Remote Services Ltd., Northwood, UK
COMMUNICATIONS COMMAND AND CONTROL: THE CROWDED SPECTRUM

Clot, Andre J., Remote Services Ltd., UK; Development and Operation of UAVs for Military and Civil Applications; April 2000, pp. 2B-1 - 2B-8; In English; See also 20000037887; Copyright Waived; Avail: CASI; A02, Hardcopy

Two key issues arise when the crew are removed from the aircraft. The first is how to get data to and from the aircraft (communications); and the second is how to operate the aircraft effectively (Command and Control). All the various methods used rely on the electromagnetic spectrum and useable space in this spectrum is becoming increasingly scarce. The provision and protection of this resource for the aviation community is an important issue. For UAV systems it could be the difference between success and failure. Whilst the number of UAVs remains small the problem may be contained. However if the UAV industry is to experience the growth it expects, this may well be the most limiting factor.
Author

Aircraft Communication; Command And Control; Electromagnetic Spectra; Pilotless Aircraft

20000037893 DaimlerChrysler Aerospace A.G., Ulm, Germany
UAV DATA-LINKS: TASKS, TYPES, TECHNOLOGIES AND EXAMPLES
Rochus, Wolfgang W., DaimlerChrysler Aerospace A.G., Germany; Development and Operation of UAVs for Military and Civil Applications; April 2000, pp. 5-1 - 5-43; In English; See also 20000037887; Copyright Waived; Avail: CASI; A03, Hardcopy

This paper provides an overview of Data-Links for UAVs. Based on the functions, which have to be performed in different UAV missions, requirements for data-links are identified. After highlighting the basic variants of data-links and their general advantages and disadvantages a detailed discussion of some important design aspects is provided. Some real-world examples of data-links show how theory has been put to use, namely: (1) Global Hawk SATCOM Data-Link as an example for an off-the-shelf solution; (2) HF Data-Link for Mucke UAV System as an example for the adaptation of MOTS hardware to a small UAV; and (3) The BREVEL Microwave DATA-Link as an example for a solution to a specific requirement. The BREVEL Data-Link is one of the most advanced solutions available today. It was developed jointly between DaimlerChrysler Aerospace AG and MATRA SYSTEM and Information until 1998 and is expected to go into production in Germany in 1999.
Author

Pilotless Aircraft; Communication Satellites; Data Links

20000091427 Research and Technology Organization, Neuilly-sur-Seine, France
MULTI-LINGUAL INTEROPERABILITY IN SPEECH TECHNOLOGY *[L'INTEROPERABILITE MULTILINGUISTIQUE DANS LA TECHNOLOGIE DE LA PAROLE]*
August 2000; 151p; In English; 13-14 Sep. 1999, Leusden, Netherlands; See also 20000091428 through 20000091447; CD-ROM contains full text document in PDF format
Report No.(s): RTO-MP-28; AC/323(IST)TP/4; ISBN 92-837-1044-4; Copyright Waived; Avail: CASI; A08, Hardcopy; A02, Microfiche; C01, CD-ROM

Communications, command and control, intelligence, and training systems are more and more making use of speech technology components: i.e. speech coders, voice controlled C2 systems, speaker and language recognition, and automated training suites. Interoperability of these systems is not a simple standardisation problem as the speech of each individual user is an uncontrolled variable such as non-native speakers using, additional to their own language, an official NATO language. For international operations, this may cause a reduced performance or even cause malfunction of an action. In order to address these topics a two-day workshop was organized focussed on the following subjects: Non-native speech and regional accents; Cross language speech processing; Identification of language and speaker; Human Perception and Assessment. This document presents the proceedings of the workshop and consists of twenty papers, four discussion reports and a final overview.
Author

Speech Recognition; Coders; Standardization; Control Systems Design

20000091428 Lernout and Hauspie Speech Products N.V., Ypres, Belgium
SPEECH RECOGNITION BY GOATS, WOLVES, SHEEP AND NON-NATIVES
VanCompernolle, Dirk, Lernout and Hauspie Speech Products N.V., Belgium; Multi-Lingual Interoperability in Speech Technology; August 2000, pp. 1-7; In English; See also 20000091427; Copyright Waived; Avail: CASI; A02, Hardcopy

This paper gives an overview of current understanding of acoustic-phonetic issues arising when trying to recognize speech from non-native speakers. Regional accents can be modeled by systematic shifts in pronunciation. These can often better be represented by multiple models, than by pronunciation variants in the dictionary. The problem of non-native speech is much more difficult because it is influenced both by native and spoken language, making a multi-model approach inappropriate. It is also characterized by a much higher speaker variability due to different levels of proficiency. A few language-pair specific rules describing the prototypical nativised pronunciation was found to be useful both in general speech recognition as in dedicated applications. However, due to the nature of the errors and the mappings, non-native speech recognition will remain inherently much harder. Moreover, the trend in speech recognition towards more detailed modeling is counterproductive for the recognition of non-natives.
Author

Speech Recognition; Abilities; Phonetics

20000091429 Delegation Generale de l'Armement, Arcueil, France
ACOUSTIC-PHONETIC MODELING OF NON-NATIVE SPEECH FOR LANGUAGE IDENTIFICATION
Wanneroy, R., Delegation Generale de l'Armement, France; Bilinski, E., Centre National de la Recherche Scientifique, France; Barras, C., Delegation Generale de l'Armement, France; Adda-Decker, M., Centre National de la Recherche Scientifique, France; Geoffrois, E., Delegation Generale de l'Armement, France; Multi-Lingual Interoperability in Speech Technology; August 2000, pp. 9-13; In English; See also 20000091427; Sponsored in part by Communications and Systems Co.; Copyright Waived; Avail: CASI; A01, Hardcopy

The aim of this paper is to investigate to what extent non native speech may deteriorate language identification (LID) performances and to improve them using acoustic adaptation. Our reference LID system is based on a phonotactic approach. The system makes use of language-independent acoustic models and language-specific phone-based bigram language models. Experiments are conducted on the SQALE test database, which contains recordings from English, French and German native speakers, and on the MIST database, which contains non-native speech in the same languages uttered by Dutch speakers. Using 5 seconds of telephone quality speech, language identification error rate amounts to 10% for native speech and to 28% for non-native speech, thus yielding an important increase in error rate in the nonnative case. We improve non-native language identification by an adaptation of the acoustic models to the non-native speech.
Author

Acoustic Properties; Deterioration; Languages; Phonetics; Speech Recognition

20000091430 Telia A.B., Farsta, Sweden
HOW FOREIGN ARE 'FOREIGN' SPEECH SOUNDS? IMPLICATIONS FOR SPEECH RECOGNITION AND SPEECH SYNTHESIS
Lindstroem, Anders, Telia A.B., Sweden; Eklund, Robert, Telia A.B., Sweden; Multi-Lingual Interoperability in Speech Technology; August 2000, pp. 15-19; In English; See also 20000091427; Copyright Waived; Avail: CASI; A01, Hardcopy

This paper reports results from a production study which shows in what ways the traditional Swedish phone set is expanded with phones similar to or approximating phones from other languages than Swedish in everyday speech. The inclusion of such sounds - here called xenophones - has implications for both automatic speech recognition and speech synthesis systems, especially in polylingual environments, which are discussed in the paper.
Author

Speech Recognition; Languages

20000091431 Maribor Univ., Maribor, Slovenia
CLUSTERING OF CONTEXT DEPENDENT SPEECH UNITS FOR MULTILINGUAL SPEECH RECOGNITION
Imperl, Bojan, Maribor Univ., Slovenia; Multi-Lingual Interoperability in Speech Technology; August 2000, pp. 21-26; In English; See also 20000091427; Copyright Waived; Avail: CASI; A02, Hardcopy

The paper addresses the problem of designing a language independent phonetic inventory for the speech recognisers with multilingual vocabulary. A new clustering algorithm for the definition of multilingual set of triphones is proposed. The clustering algorithm bases on a definition of a distance measure for triphones defined as a weighted sum of explicit estimates of the context similarity on a monophone level. The monophone similarity estimation method based on the algorithm of Houtgast. The clustering algorithm is integrated in a multilingual speech recognition system based on HTK V21.1. The experiments were based on the SpeechDat 11 databases'. So far, experiments included the Slovenian, Spanish and German 1000 FDB SpeechDat (II) databases. Experiments have shown that the use of clustering algorithm results in a significant reduction of the number of triphones with minor degradation of word accuracy.
Author
Algorithms; Cluster Analysis; Inventories; Phonetics; Speech Recognition

20000091432 Institute for Human Factors TNO, Soesterberg, Netherlands
SPEECH RECOGNITION OF NON-NATIVE SPEECH USING NATIVE AND NON-NATIVE ACOUSTIC MODELS
vanLeeuwen, David A., Institute for Human Factors TNO, Netherlands; Orr, Rosemary, University Hospital, Netherlands; Multi-Lingual Interoperability in Speech Technology; August 2000, pp. 27-32; In English; See also 20000091427; Copyright Waived; Avail: CASI; A02, Hardcopy

A speech recognition system is subjected to the speech of non-native speakers, using both native and non-native acoustic phone models. The problems involved with the mapping of phoneset from the non-native to native language are investigated, and a detailed analysis of phone confusions is made. For Dutch speakers, British English acoustic models give the best word recognition results.
Author
Speech Recognition; Acoustic Properties; Acoustic Simulation; Confusion

20000091433 BT Adastral Park, Ipswich, UK
AN OVERVIEW OF THE EURESCOM MIVA PROJECT
Johnston, Denis, BT Adastral Park, UK; Multi-Lingual Interoperability in Speech Technology; August 2000, pp. 35-41; In English; See also 20000091427; Copyright Waived; Avail: CASI; A02, Hardcopy

The goal of the MIVA project was to answer a number of fundamental questions concerned with the exploitation of speech technology enabled systems. The experimental service chosen was designed to help foreign people travelling in the country to find emergency and embassy numbers, country and area codes, useful numbers (directory service, country direct, etc.) and how to use Telecom and credit cards for placing calls. Services were implemented in each of the countries taking part and two stages of experimentation were undertaken. The first of these was a monolingual experiment carried out in each country to optimize performance for each country /language combination. The second was a fully multi-lingual service in which each of these optimized services was re-implemented in all languages. All systems were evaluated over combinations of local and international environments. Correlations derived from a subset of the subjective and objective results were used to provide a predictive model of users opinions and the remaining subset of data used to test these predictions.
Author
Directories; Languages; Predictions; Technology Assessment

20000091434 Colorado Univ., Center for Spoken Language Understanding, Boulder, CO USA
A PLATFORM FOR MULTILINGUAL RESEARCH IN SPOKEN DIALOGUE SYSTEMS
Cole, Ronald A., Colorado Univ., USA; Serridge, Ben, Universidad de las Americas, Mexico; Hosom, John-Paul, Oregon Graduate Inst. of Science and Technology, USA; Cronk, Andrew, Oregon Graduate Inst. of Science and Technology, USA; Kaiser, Ed, Oregon Graduate Inst. of Science and Technology, USA; Multi-Lingual Interoperability in Speech Technology; August 2000, pp. 43-48; In English; See also 20000091427
Contract(s)/Grant(s): N00014-94-I-1154; NSF CDA-97-26363; UCB/NSF/153-0584; NSF IIS-96-14217; NSF IIS-98-75950; Copyright Waived; Avail: CASI; A02, Hardcopy

Multilingual speech technology research would be greatly facilitated by an integrated and comprehensive set of software tools that enable research and development of core language technologies and interactive language systems in any language. Such a multilingual platform has been one of our goals in developing the CSLU Toolkit. The Toolkit is composed of components that are essentially language-independent, and support research and development of recognition, understanding, text-to-speech synthesis, facial animation, and spoken dialogue systems. Portions of the Toolkit have already been ported to Italian, German, and Vietnamese. In addition, a complete Mexican-Spanish version of the Toolkit has been created, and is in daily use at the Universidad de las Americas in Puebla (UDLA). In this paper we outline some of the issues involved in porting the Toolkit to a new language, and describe why the Toolkit is well suited to multilingual adaptation.
Author
Research; Speech; Languages

20000091435 Coimbra Univ., Dep. Engenharia Electrotecnica, Coimbra, Portugal
AUDITORY FEATURES UNDERLYING CROSS-LANGUAGE HUMAN CAPABILITIES IN STOP CONSONANT DISCRIMINATION
SaMarta, Eduardo, Coimbra Univ., Portugal; deSa, Luis Vieira, Coimbra Univ., Portugal; Multi-Lingual Interoperability in Speech Technology; August 2000, pp. 49-54; In English; See also 20000091427
Contract(s)/Grant(s): Praxix 2/2.1/TIT/1558/95; Copyright Waived; Avail: CASI; A02, Hardcopy

For some phonemic distinctions human listeners exhibit a marked cross-language capability, in that they are capable of highly correct classification in relation to sounds (like CVs or VCVs) uttered by speakers of another language. This is particularly true regarding distinctions that are perceived in a more categorical fashion, like that of 3-way PLACE discrimination in stop consonants. It is plausible that the reason for this is a mostly common (across languages) auditory basis for human communication of this discrimination. Also, human communication of this discrimination is notably impervious to non-drastic variations in the frequency-transfer curve, which suggests that the relevant auditory features must have some inherent insensitivity to these variations. Models for two specialized auditory cells (onset cells with wide receptive fields, which can detect weak onsets synchronized across frequency, and sequence cells which detect frequency-ascending sequences composed of two onsets) were refined for the discrimination of DENTAL vs LABIAL stop consonants and applied to large spelling databases in Portuguese, German, and U.S. English. Similar discriminatory capability was observed both for German and U.S. English. Integration with a 3rd auditory feature resulted in error scores of approximately 2% when exactly the same model is applied to either German or U.S. English sounds.
Author
Consonants (Speech); Data Bases; Sensitivity; Refining; Human Performance; Discrimination

20000091436 Dynastat, Inc., Austin, TX USA
USES OF THE DIAGNOSTIC RHYME TEST (ENGLISH VERSION) FOR PREDICTING THE EFFECTS OF COMMUNICATORS' LINGUISTIC BACKGROUNDS ON VOICE COMMUNICATIONS IN ENGLISH: AN EXPLORATORY STUDY
Voiers, William D., Dynastat, Inc., USA; Multi-Lingual Interoperability in Speech Technology; August 2000, pp. 55-60; In English; See also 20000091427; Copyright Waived; Avail: CASI; A02, Hardcopy

Recordings of Diagnostic Rhyme Test (DRT) materials by native talkers of English (American), German and French were presented under undegraded and degraded conditions to English speaking listening crews of three national origins: American, German and French. The results were analyzed for the effects of the talker's native language, the listener's native language and all permutations

of the two on scores yielded by the DRT. With undegraded speech, the total number of errors was lowest when the talkers were American, regardless of the nationality of the listeners, and when the listeners were American, regardless of the nationality of the talkers. On average, French talkers yielded the lowest DRT scores, but the interaction of talker nationality and listener nationality was significant. Errors of discrimination with respect to voicing, sustention, sibilation and graveness occurred most often.
Author
Intelligibility; Voice Communication; Permutations

20000091437 Institute for Human Factors TNO, Soesterberg, Netherlands
SPEECH INTELLIGIBILITY OF NATIVE AND NON-NATIVE SPEECH
vanWijngaarden, Sander J., Institute for Human Factors TNO, Netherlands; Multi-Lingual Interoperability in Speech Technology; August 2000, pp. 61-66; In English; See also 20000091427; Copyright Waived; Avail: CASI; A02, Hardcopy

The intelligibility of speech is known to be lower if the talker is non-native instead of native for the given language. This study is aimed at quantifying the overall degradation due to acoustic-phonetic limitations of non-native talkers of Dutch, specifically of Dutch-speaking Americans who have lived in the Netherlands 1-3 years. Experiments were performed using phoneme intelligibility and sentence intelligibility tests, using additive noise as a means of degrading the intelligibility of speech utterances for test purposes. The overall difference in sentence intelligibility between native Dutch talkers and American talkers of Dutch, using native Dutch listeners, was found to correspond to a difference in speech-to-noise ratio of approximately 3 dB. The main contribution to the degradation of speech intelligibility by introducing non-native talkers and/or listeners, is by confusion of vowels, especially those that do not occur in American English.
Author
Degradation; Intelligibility; Phonetics; Speech Recognition

20000091438 Centre National de la Recherche Scientifique, Spoken Language Processing Group, Orsay, France
TOWARDS MULTILINGUAL INTEROPERABILITY IN AUTOMATIC SPEECH RECOGNITION
Adda-Decker, Martine, Centre National de la Recherche Scientifique, France; Multi-Lingual Interoperability in Speech Technology; August 2000, pp. 69-76; In English; See also 20000091427; Copyright Waived; Avail: CASI; A02, Hardcopy

In this communication, we address multilingual interoperability aspects in speech recognition. After giving a tentative definition of multilingual interoperability, we discuss speech recognition components and their language-specific aspects. We give a sample overview of past multilingual speech recognition research and development across different speaking styles (read, prepared and conversational). The problem of adaptation to new languages is addressed. Language-independent and cross-language techniques for acoustic modeling provide a means to port recognition systems to new languages without language specific acoustic data. Pronunciation lexica and text material appear to be the most crucial language-dependent resources for porting. Fast porting being a step towards multilingual interoperability the ongoing efforts of producing multilingual pronunciation lexica and collecting multilingual text corpora should be extended to the largest possible number of written languages.
Author
Speech Recognition; Communication; Languages

20000091439 Centro Studi e Laboratori Telecomunicazioni, Turin, Italy
MULTILINGUAL VOCABULARIES IN AUTOMATIC SPEECH RECOGNITION
Micca, Giorgio, Centro Studi e Laboratori Telecomunicazioni, Italy; Palme, Enrico, Pisa Univ., Italy; Frasca, Alessandra, La Sapienza Univ., Italy; Multi-Lingual Interoperability in Speech Technology; August 2000, pp. 77-80; In English; See also 20000091427; Copyright Waived; Avail: CASI; A01, Hardcopy

The paper describes a method for dealing with multilingual vocabularies in speech recognition tasks. We present an approach that combines acoustic descriptive precision and capability of generalization to multiple languages. The approach is based on the concept of classes of transitions between phones. The classes are defined by means of objective measures on acoustic similarities among sounds of different languages. This procedure stems from the definition of a general language-independent model. When a new language is to be added, the phonological structure of the language is mapped onto the set of classes belonging to the general model. Successively, if a limited amount of language-specific speech data becomes available for the new language, we identify those sounds which require the definition of additional classes. The experiments have been conducted in Italian, English and Spanish languages. The method can also be considered as a way of implementing cross-lingual porting of recognition models for a rapid prototyping of recognizers in a new target language, specifically in cases whereby the collection of large training databases would be economically infeasible.
Author
Analogies; Data Bases; Languages; Speech Recognition

20000091440 Bavarian Research Center for Knowledge Based Systems, Research Group for Knowledge Processing, Erlangen, Germany
SPEECH RECOGNITION IN SEVEN LANGUAGES
Uebler, Ulla, Bavarian Research Center for Knowledge Based Systems, Germany; Multi-Lingual Interoperability in Speech Technology; August 2000, pp. 81-86; In English; See also 20000091427; Copyright Waived; Avail: CASI; A02, Hardcopy

In this study we present approaches to multilingual speech recognition. We first define different approaches, namely portation, cross-lingual and simultaneous multilingual speech recognition and present results in these approaches. In recent years we have ported our recognizer to other languages than German. Some experiments presented here show the performance of cross-lingual speech recognition of an untrained language with a recognizer trained with other languages. Our results show that some languages like Italian are per se easier to recognize with any of the recognizers than other languages. The substitution of phones for cross-lingual recognition is an important point and we compared results in cross-lingual recognition for different baseline systems and found that the number of shared acoustic units is very important for the performance.
Author
Languages; Speech Recognition; Acoustic Imaging

20000091441 Dragon Systems UK Research and Development Ltd., Cheltenham, UK
A MILITARILY OPERATIONAL AUTOMATIC INTERPRETING SYSTEM
Bamberg, Paul, Dragon Systems, Inc., USA; Tucker, Jay, Dragon Systems, Inc., USA; Anderson, Steven, Dragon Systems, Inc., USA; Hunt, Melvyn, Dragon Systems UK Research and Development Ltd., UK; Multi-Lingual Interoperability in Speech Technology; August 2000, pp. 87-90; In English; See also 20000091427; Copyright Waived; Avail: CASI; A01, Hardcopy

This paper describes a real-time interpreting system in which the operator speaks one of around 4000 phrases in one language, which is automatically recognised and the corresponding spoken phrase in the target language is played through a loudspeaker. This system has been used operationally by NATO forces. The basic system is first described, followed by an account of the wide range of uses to which this relatively simple one-way interpreting system can be put. Some developments of the basic system are then listed, both developments that are already in place and some that have potential for future implementation. Finally, an account is given of some relevant research on the use of statistical phonetic mapping techniques for extending the usability of such systems to non-native speakers of the source language.
Author
Phonetics; Statistical Analysis; Real Time Operation; Speech Recognition

20000091442 Gesellschaft fuer Mathematik und Datenverarbeitung, Inst. for Media Communication, Saint Augustin, Germany
COMPARING THREE METHODS TO CREATE MULTILINGUAL PHONE MODELS FOR VOCABULARY INDEPENDENT SPEECH RECOGNITION TASKS

Koehler, Joachim, Gesellschaft fuer Mathematik und Datenverarbeitung, Germany; Multi-Lingual Interoperability in Speech Technology; August 2000, pp. 91-96; In English; See also 20000091427; Copyright Waived; Avail: CASI; A02, Hardcopy

This paper presents three different methods to develop multilingual phone models for flexible speech recognition tasks. The main goal of our investigations is to find multilingual speech units which work equally well in many languages. With this universal set it is possible to build speech recognition systems for a variety of languages. One advantage of this approach is to share acoustic-phonetic parameters in a HMM based speech recognition system. The multilingual approach starts with the phone set of six languages ending up with 232 language-dependent and context-independent phone models. Then, we developed three different methods to map the language-dependent models to a multilingual phone set. The first method is a direct mapping to the phone set of the International Phonetic Association (IPA). In the second approach we apply an automatic clustering algorithm for the phone models. The third method exploits the similarities of single mixture components of the language-dependent models. Like the first method the language specific models are mapped to the IPA inventory. In the second step an agglomerative clustering is performed on density level to find regions of similarities between the phone models of different languages. The experiments carried out with the SpeechDat(M) database show that the third method yields in almost the same recognition rate as with language-dependent models. However, using this method we observe a huge reduction of the number of densities in the multilingual system.
Author
Speech Recognition; Languages; Cluster Analysis; Analogies

20000091443 Karlsruhe Univ., Interactive Systems Labs., Germany
LANGUAGE ADAPTIVE LVCSR THROUGH POLYPHONE DECISION TREE SPECIALIZATION
Schultz, T., Karlsruhe Univ., Germany; Waibel, A., Karlsruhe Univ., Germany; Multi-Lingual Interoperability in Speech Technology; August 2000, pp. 97-102; In English; See also 20000091427; Copyright Waived; Avail: CASI; A02, Hardcopy

With the distribution of speech technology products all over the world, the fast and efficient portability to new target languages becomes a practical concern. In this paper we explore the relative effectiveness of porting multilingual recognition systems to new target languages with very limited adaptation data. For this purpose we introduce a polyphone decision tree specialization method. Several recognition results are presented based on mono- and multilingual recognizers developed in the framework of the project GlobalPhone which investigates LVCSR systems in 15 languages.
Author
Languages; Speech Recognition

20000091444 Massachusetts Inst. of Tech., Information Systems Technology Group, Lexington, MA USA
AUTOMATIC LANGUAGE IDENTIFICATION
Zissman, Marc A., Massachusetts Inst. of Tech., USA; Berkling, Kay M., Massachusetts Inst. of Tech., USA; Multi-Lingual Interoperability in Speech Technology; August 2000, pp. 105-113; In English; See also 20000091427
Contract(s)/Grant(s): F19628-95-C-0002; Copyright Waived; Avail: CASI; A02, Hardcopy

Automatic language identification is the process by which the language of a digitized speech utterance is recognized by a computer. In this paper, we will describe the set of available cues for language identification and discuss the different approaches to building working systems. This overview includes a range of historic approaches, contemporary systems that have been evaluated on standard databases, as well as promising future approaches. Comparative results are also reported.
Author
Speech Recognition; Technology Assessment

20000091445 Mons Univ., Faculte Polytechnique, Belgium
MULTILINGUAL TEXT-INDEPENDENT SPEAKER IDENTIFICATION
Durou, Geoffrey, Mons Univ., Belgium; Multi-Lingual Interoperability in Speech Technology; August 2000, pp. 115-118; In English; See also 20000091427; Copyright Waived; Avail: CASI; A01, Hardcopy

In this paper, we investigate two facets of speaker recognition: cross-language speaker identification and same-language non-native text-independent speaker identification. In this context, experiments have been conducted, using standard multi-gaussian modeling, on the brand new multi-language TNO corpus. Our results indicate how speaker identification performance might be affected when speakers do not use the same language during the training and testing, or when the population is composed of non-native speakers.
Author
Speech Recognition; Research; Education

20000091446 Lyon-2 Univ., Laboratoire Dynamique du Langage, Lyon, France
VOWEL SYSTEM MODELING: A COMPLEMENT TO PHONETIC MODELING IN LANGUAGE IDENTIFICATION
Farinas, Jerome, Centre National de Recherches de l'Espace, France; Andre-Obrecht, Regine, Centre National de Recherches de l'Espace, France; Pellegrino, Francois, Lyon-2 Univ., France; Multi-Lingual Interoperability in Speech Technology; August 2000, pp. 119-124; In English; See also 20000091427; Copyright Waived; Avail: CASI; A02, Hardcopy

Most systems of Automatic Language Identification are based on phonotactic approaches. However, it is more and more evident that taking other features (phonetic, phonological, prosodic, etc.) into account will improve performances. This paper presents an unsupervised phonetic approach that aims to consider phonological cues related to the structure of vocalic and consonantal systems. In this approach, unsupervised vowel/non vowel detection is used to model separately vocalic and consonantal systems. These Gaussian Mixture Models are initialized with a data-driven variant of the LBG algorithm: the LBG-Rissanen algorithm. With 5 languages from the OGI MLTS corpus and in a closed set identification task, the system reaches 85 % of correct identification using 45-second duration utterances for male speakers. Using the vowel system modeling as a complement to an unsupervised phonetic modeling increases this performance up to 91 % while still requiring no labeled data.
Author
Vowels; Models; Speech Recognition; Algorithms

20000091447 Massachusetts Inst. of Tech., Lincoln Lab., Lexington, MA USA
SCOPE, SYLLABLE CORE AND PERIPHERY EVALUATION: AUTOMATIC SYLLABIFICATION AND APPLICATION TO FOREIGN ACCENT IDENTIFICATION
Berkling, Kay, Massachusetts Inst. of Tech., USA; Vonwiller, Julie, Sydney Univ., Australia; Cleirigh, Chris, Sydney Univ., Australia; Multi-Lingual Interoperability in Speech Technology; August 2000, pp. 125-130; In English; See also 20000091427; Copyright Waived; Avail: CASI; A02, Hardcopy

In this paper we apply a study of the structure of the English language towards an automatic syllabification algorithm. Elements of syllable structure are defined according to both their position in the syllable and to the position of the syllable within word structure. Elements of syllable structure that only occur at morpheme boundaries or that extend for the duration of morphemes are identified as peripheral elements; those that can occur anywhere with regard to word morphology are identified as core elements. All languages potentially make a distinction between core and peripheral elements of their syllable structure, however the specific forms these structures take will vary from language to language. In addition to problems posed by differences in phoneme inventories, we expect speakers with the greatest syllable structural differences between native and foreign language to have greatest difficulty with pronunciation in the foreign language. In this paper we will analyse two accents of Australian English: Arabic whose core/periphery structure is similar to English and Vietnamese, whose structure is maximally different to English.
Author
Speech Recognition; Research; English Language; Syllables; Algorithms

20000108808 Raytheon Co., Alpharetta, GA USA
AUTOMATIC TARGET RECOGNITION (ATR) BEYOND THE YEAR 2000

Licata, William H., Raytheon Co., USA; Technologies for Future Precision Strike Missile Systems; September 2000, pp. 9-1 - 9-10; In English; See also 20000108801; Copyright Waived; Avail: CASI; A02, Hardcopy

The goal of this paper is to project those video or picture based Automatic Target Recognition (ATR) systems likely to enter military inventories and alter mission planning in the year 2000 and beyond. Therefore, this paper avoids a discussion of specific technical approaches and their relative merits that often leads into proprietary or classified discussions. An emphasis is place on the attributes of ATR as a military product and the factors that will determine the success or failure of efforts to move them in large quantities into military inventories. Some suggestions will be given on how the time to market can be shortened and where video ATR systems will first appear on the post cold war battlefield.
Author
Target Recognition; Missile Signatures; Missile Systems; Automatic Control; Missile Control; Missiles; Discrimination

20010003257 Institute for Human Factors TNO, Soesterberg, Netherlands
INTERFACE CONCEPTS FOR COMMAND AND CONTROL TASKS
vanDelft, Jan H., Institute for Human Factors TNO, Netherlands; Passenier, Peter O., Institute for Human Factors TNO, Netherlands; Usability of Information in Battle Management Operations; November 2000, pp. 14-1 - 14-8; In English; See also 20010003245; Copyright Waived; Avail: CASI; A02, Hardcopy

This paper addresses new interface concepts for information visualization and manipulation in Command and Control. These concepts focus on the use of multiple views on the tactical situation to enhance situational awareness and to improve situation assessment. Topics covered include the application of 3D perspective and stereoscopic displays.
Author
Command And Control; Display Devices; Information Management; Information Systems; Information Flow

20010012841 European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk, Netherlands
HIGH RESOLUTION X-BAND SAR CONSTELLATION FOR RISK MANAGEMENT
Lin, C. C., European Space Agency. European Space Research and Technology Center, ESTEC, Netherlands; Ramongassie, S., Alcatel Espace, France; Jerome, M., Alcatel Espace, France; Phalippou, L., Alcatel Espace, France; Space-Based Observation Technology; October 2000, pp. 36-1 - 36-8; In English; See also 20010012824; Original contains color illustrations; Copyright Waived; Avail: CASI; A02, Hardcopy

This paper summarizes the result of an ESA sponsored study on a Risk Management Earth Watch mission. The proposed system consists of a constellation of X-band SAR satellites so as to provide essential and complementary information with respect to other observing systems whether space or terrestrial. The mission requirements to meet both high spatial and temporal resolution, combined with fast data delivery led to two unique, alternative SAR-satellite designs which combine both the electronic and platform agilities.
Derived from text
High Resolution; Superhigh Frequencies; Synthetic Aperture Radar; Risk

20010012843 National Technical Univ., Dept. of Electrical and Computer Engineering, Athens, Greece
ANALYSIS OF P-BAND SYNTHETIC APERTURE RADAR FOR AIRBORNE AND SPACEBORNE APPLICATIONS
Potsis, A., National Technical Univ., Greece; Uzunoglou, N., National Technical Univ., Greece; Frangos, P., National Technical Univ., Greece; Horn, R., Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; Lamprecht, K., Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; Space-Based Observation Technology; October 2000, pp. 40-1 - 40-12; In English; See also 20010012824; Original contains color illustration; Sponsord in part by DaimlerChrysler Aerospace Hellas; Copyright Waived; Avail: CASI; A03, Hardcopy

An increasing amount of interest has evolved in VBF/UHF SAR applications. These types of radars have proven to be a very powerful method for underground and obscured object detection. In this paper we analyze the possibility of a spaceborne P-band SAR system, based on the experience gained from the analysis of the experimental airborne P-band SAR (ESAR) system of DLR. We address possible methods and filters for effective Radio Frequency Interference (RFI) suppression, polarimetric and radiometric calibration procedures. We also assess the problems concerning the image quality degradation due to ionospheric propagation effects based on several simulation models.
Derived from text
P Band; Synthetic Aperture Radar; Airborne Equipment

20010012844 Centre National d'Etudes Spatiales, Toulouse, France
THE RF PRISM CONCEPT FOR PUSHING FORWARD THE ANTENNA SIZE BARRIER IN SPACE BASED RADAR
Aguttes, Jean Paul, Centre National d'Etudes Spatiales, France; Space-Based Observation Technology; October 2000, pp. 42-1 - 42-7; In English; See also 20010012824; Original contains color illustration; Copyright Waived; Avail: CASI; A02, Hardcopy

RF PRISM is a new space antenna concept where an array is fed through a mesh of points on the antenna back face with RF signals transmitted (or received) by another satellite called illuminator and usually offset by 100 Km on the same orbit. Basically the PRISM deviates, amplifies, and beam forms the signals passing through it and travelling between the illuminator and the earth. Providing that the speed vector and the main earth viewing axis have equal incidence on antenna plane the antenna deformation control or knowledge requirement is relaxed by a factor 10. Moreover there are no longer cables between the antenna panels. RF PRISM therefore enables deployment of very large antenna in space. The illuminator satellite is not constrained by the illumination function (a few Watts and a 1 sq m antenna), but just by the central payload function moved away from the satellite bearing the antenna. This can be a micro-satellite. Among others applications, this concept opens up new prospects for space-borne SAR requiring a very large antenna structure either for very low frequency (P-band), or for very high attitude (high revisit or for single pass interferometry (two antennas). Optionally it can be combined with the SAIL that is an another concept circumventing large antenna constraints (vertical antenna with gravity stabilisation). A short overview of the concept applied to Radar has already been presented at IGARSS 2000 (Honolulu) and published in proceeding (/2/). This papers goes more in details in term of practical implementation of the concept.
Author
Antenna Design; Large Space Structures; Satellite Antennas; Spacecraft Antennas; Space Based Radar

20010012845 Defence Research Establishment Ottawa, Space Systems and Technology Section, Ottawa, Ontario Canada
COMPUTER SIMULATIONS OF CANADA'S RADARSAT2 GMTI
Chiu, Shen, Defence Research Establishment Ottawa, Canada; Livingstone, Chuck, Defence Research Establishment Ottawa, Canada; Knight, Tony, MacDonald, Dettwiler and Associates Ltd., Canada; Sikaneta, Ishuwa, MacDonald, Dettwiler and Associates Ltd., Canada; Space-Based Observation Technology; October 2000, pp. 45-1 - 45-8; In English; See also 20010012824; Original contains color illustrations; Copyright Waived; Avail: CASI; A02, Hardcopy

Canada's RADARSAT2 commercial SAR satellite will have an experimental operating mode that will allow ground moving target indication (GMTI) measurements to be made with received data. This mode is also called MODEX (Moving Object Detection Experiment). In the GMTI or MODEX mode of operation, the spacecraft's radar antenna is partitioned into two apertures that sequentially observe the scene of interest from the same points in space. Data is simultaneously and coherently received from both apertures and is down-linked in parallel channels for processing to extract moving target radial speeds in their SAR image context. This paper provides an analysis of SAR-GMTI performance based on computer modeling and simulations. Two SAR-MTI processing approaches are being explored. One utilizes the classical DPCA clutter cancellation technique to provide sub-clutter visibility for dim slowly moving targets. The other is based on the along-track (temporal) SAR interferometer technique, where amplitude and phase information of the slow-moving targets are exploited to extract them from the dominant

clutter background. Performances of the two approaches are compared.
Author
Computerized Simulation; Radarsat; Synthetic Aperture Radar; Canadian Space Program; Radar Antennas

20010012846 Alenia Spazio S.p.A., Remote Sensing Engineering, Rome, Italy
A REAL-TIME SAR PROCESSOR USING ONE-BIT RAW SIGNAL CODING FOR SRTM
Impagnatiello, F., Alenia Spazio S.p.A., Italy; Gallon, A., Alenia Spazio S.p.A., Italy; Buscaglione, F., Alenia Spazio S.p.A., Italy; Ferrara, M. N., Alenia Spazio S.p.A., Italy; Nirchio, F., Italian Space Agency, Italy; Space-Based Observation Technology; October 2000, pp. 47-1 - 47-9; In English; See also 20010012824; Copyright Waived; Avail: CASI; A02, Hardcopy

The great success of the two SIR-C/X-SAR missions and the lack of global topographic data are the reasons at the basis of third Shuttle Radar Topographic Mission (SRTM). The mission is a joint program among NASA NIMA, DLR and the Italian Space Agency. The SRTM mission aims is to create a tri-dimensional topographic map of the Earth's surface 30 times as precise as the best global maps in use today. The sophisticated mission technology is able to produce topographic maps with a level of detail never achieved before and a very good height precision. The technique used, based on microwave instruments with a synthetic aperture radar, is a totally new concept in geodesy, the science that studies the morphology of planet Earth and measures its characteristics. The mission has been also a great opportunity to test in an operational contest a innovative one bit processing chain operating in the pure time domain. The processor focuses the X-SAR signum coded raw data applying a quasi-phase preserving algorithm. The equivalent computing power is about 8,000 billions operations per second. The processor architecture is such to comply with the continuous data flow coming from the instrument delivering a striped image. Alenia Spazio, beside the responsibility with Dormer of the design and realization of the X-band radar, also in this case under ASI contract, has designed and realised a complete ground station organized as a X-band data Processing Chain installed and operated at JPL site. This includes a Real-Time SAR processor, a comprehensive data management system and finally a topographic post-processing station. Astonishing results have been produced both as singlebit focused SAR images and digital elevation models, also thanks to the advanced capabilities developed in last Years at University Federico II of Naples one of the more active research institutions in this field.
Derived from text
Shuttle Imaging Radar; Radar Imagery; Imaging Radar; Real Time Operation; Topography; Relief Maps

20010012847 Deutsches Zentrum fuer Luft- und Raumfahrt e.V., Inst. fuer Hochfrequenztechnik und Radaarsysteme, Oberpfaffenhofen, Germany
INTERFEROMETRIC PROCESSING OF SPACEBORNE SAR DATA IN ADVANCED SAR IMAGING MODES
Mittermayer, Josef, Deutsches Zentrum fuer Luft- und Raumfahrt e.V., Germany; Moreira, Alberto, Deutsches Zentrum fuer Luft- und Raumfahrt e.V., Germany; Space-Based Observation Technology; October 2000, pp. 48-1 - 48-8; In English; See also 20010012824; Copyright Waived; Avail: CASI; A02, Hardcopy

The paper gives an analysis of ScanSAR and Spotlight data and identifies their common properties and the differences. A generic processing algorithm which consists of the Extended Chirp Scaling algorithm and the Frequency Scaling algorithm is proposed for high precision phase preserving processing of ScanSAR and SpotSAR imaging modes for future spaceborne SAR systems. The ScanSAR processing performance is demonstrated by the interferometric processing of Radarsat ScanSAR data. The SpotSAR processing is validated using raw data from the airborne experimental SAR-System (E-SAR) of DLR.
Derived from text
Interferometry; Synthetic Aperture Radar; Radarsat; Image Processing; Imaging Techniques

20010012848 National Technical Univ., Div. of Electroscience, Athens, Greece
LINEAR FEATURES' DETECTION IN SAR IMAGES USING FUZZY EDGE DETECTOR (FED)
Dimou, Alexandros, National Technical Univ., Greece; Uzunoglow, Nicolaos, National Technical Univ., Greece; Frangos, Panagiotis, National Technical Univ., Greece; Jaeger, Gunther, Deutsches Zentrum fuer Luft- und Raumfahrt e.V., Germany; Benz, Ursula, Deutsches Zentrum fuer Luft- und Raumfahrt e.V., Germany; Space-Based Observation Technology; October 2000, pp. 49-1 - 49-12; In English; See also 20010012824; Original contains color illustrations; Sponsord in part by DaimlerChrysler Aerospace Hellas; Copyright Waived; Avail: CASI; A03, Hardcopy

Synthetic Aperture Radar (SAR) images exploitation is of great importance in remote sensing and Earth observation techniques, as well as in military surveillance and reconnaissance missions. One of the most important image-processing techniques is image segmentation. Segmentation subdivides an image into its constituent parts or objects. Edge detection is often an important first stage in many types of image segmentation. It can be used to simplify complex imagery in preparation for subsequent feature identification. Detection of linear structures (road network, airfields e.t.c.) is of great interest in a potential automated recognition system. A new approach for edge detection in SAR images, which overcomes the necessity of choosing arbitrary thresholds is described in this paper. The Fuzzy Edge Detector (FED) not only discriminates between edge pixels and no-edge pixels, but assigns each image point a degree of being an edge point. This intermediate fuzzy output enables a very flexible post-processing and thus an efficient edge detection processing chain (e.g. non-maximum suppression and edge linking). Additionally, the edge direction information resulting from FED can be used for linear features' identification and extraction. The performance of the proposed edge detector on airborne and spaceborne SAR images that include linear features is presented.
Derived from text
Radar Imagery; Synthetic Aperture Radar; Image Processing; Imaging Techniques; Edge Detection

20010019321 BAE Systems, Research Centre, UK
ENVIRONMENT FOR SIGNAL PROCESSING APPLICATION DEVELOPMENT AND PROTOTYPING - ESPADON
Madahar, Bob, Signaal, Netherlands; Hunink, Jan, Signaal, Netherlands; Edelin, Gilbert, Thomson-CSF Detexis, France; Smith, James, Thomson Marconi Sonar Ltd., UK; Saget, Brigitte, Matra BAe Dynamics, France; Commercial Off-the-Shelf Products in Defence Applications 'The Ruthless Pursuit of COTS'; December 2000, pp. 4-1 - 4-12; In English; See also 20010019317
Contract(s)/Grant(s): Proj. RTP2.29
Report No.(s): ISBN 92-837-1049-5; Copyright Waived; Avail: CASI; A03, Hardcopy

Defense industries are increasingly expected to field state-of-the-art products, at significantly lower costs, over significantly shorter time scales, and with significantly greater functionality. New designs, as well as design upgrades, are expected to keep pace with technology advancements, particularly in microelectronics. These constraints, and others, are forcing industry increasingly towards Commercial Off-the-Shelf (COTS) components (hardware and software). The advantages are reduced costs and state-of-the-art technology compared to proprietary in-house developments, and hardwired solutions, which have long development times and are invariably out of date by the time the product is commissioned. The disadvantages are principally non-compliance with rigid military specifications of the COTS components and the inability of defence industry product design development and integration methodologies, established over many years, to accommodate the COTS components in an efficient and timely manner. Obsolescence (more acute for bespoke designs) created by COTS components for the long life-cycle military products, is also a key concern and leads to costly retrofits unless the potential design upgrade is included in the design methodology.
Author
Computer Programs; Product Development; Commercialization; Prototypes

20010019330 Defence Science and Technology Organisation, Wireless Systems Group, Australia
APPLICATION OF COTS COMMUNICATIONS SERVICES FOR

COMMAND AND CONTROL OF MILITARY FORCES
Kerr, Peter, Defence Science and Technology Organisation, Australia; McCarthy, Jeff, Defence Science and Technology Organisation, Australia; Commercial Off-the-Shelf Products in Defence Applications 'The Ruthless Pursuit of COTS'; December 2000, pp. 14-1 - 14-5; In English; See also 20010019317
Report No.(s): ISBN 92-837-1049-5; Copyright Waived; Avail: CASI; A01, Hardcopy

This paper describes issues related to the use of commercial communication systems in support of military command and control. These systems provide paging (messaging) and telephony services with global reach using small (personal), autonomously powered terminals. New commercial telephony and paging systems offer ready access to advanced communications technology for a range of benign and hostile forces including the military, government agencies, media organizations, emergency services, insurgents, and terrorists. The size, cost, coverage, and ubiquity of all of these systems combined with the availability of tools targeting internet application development creates an interesting mix of threat and opportunity for military organizations. One of the key advantages offered by the group of new telecommunications networks is diversity. Diversity of supply may enable a future adversary to use up to five systems in order to provide a voice service. For example, a user could subscribe to voice services based on GSM, CDMA, Inmarsat, Iridium, Globalstar systems using only three terminals that could easily fit into a briefcase. These example systems would operate in five different frequency bands and all are highly independent of each other in terms of the supporting network. This paper is structured in the following way. Section two describes some high level attributes required of these commercial systems in order to operate in a military communication environment. Section three highlights the differences that would typically exist between the commercial and military communication markets and their associated procurement strategies. Section four provides some examples of Commercial Off-the-Shelf (COTS) solutions for military applications, which include Command and Control Warfare (C2W), and the application of COTS for Australian Defence Force (ADF) communications.
Author
Telecommunication; Commercialization; Technology Utilization; Command And Control

20010019338 Rohde and Schwartz, Radiomonitoring and Radiolocation Div., Munich, Germany
EXPERIENCES IN DESIGNING RADIO MONITORING SYSTEMS USING COMMERCIAL OFF- THE-SHELF (COTS) COMPONENTS
Palten, Guenter, Rohde and Schwartz, Germany; Commercial Off-the-Shelf Products in Defence Applications 'The Ruthless Pursuit of COTS'; December 2000, pp. 24-1 - 24-11; In English; See also 20010019317
Report No.(s): ISBN 92-837-1049-5; Copyright Waived; Avail: CASI; A03, Hardcopy

As military tasks become more and more complex budget will increasingly be limited due to the national economic demands. Simultaneously customer specific requirements on near real-time processing, high availability, tailored systems, and integrability into NATO Interoperability Management Policy are growing. The new challenge for developers and designers on the one hand consists in meeting these customer requirements and in offering modular and flexible components which can be integrated into legacy systems. On the other hand development costs have to be reduced and the time for assembling and delivering systems have to be shortened. Therefore systems for military purposes have to integrate and have to be developed with more and more extendable and pre-built standard Commercial Off-the-Shelf (COTS) components.
Author
Technology Utilization; Commercialization; Computer Programs; Surveillance

20010019339 Rohde and Schwartz, Munich, Germany
WIRELESS TCP/IP AND COMBINATION WITH BROADBAND MEDIA
Kneidel, Thomas A., Rohde and Schwartz, Germany; Commercial Off-the-Shelf Products in Defence Applications 'The Ruthless Pursuit of COTS'; December 2000, pp. 21-1 - 21-7; In English; See also 20010019317
Report No.(s): ISBN 92-837-1049-5; Copyright Waived; Avail: CASI; A02, Hardcopy

The presentation shows products for new applications (mobile IP) by using Commercial Off-the-Shelf (COTS) hardware and software components. This COTS-components are implemented and adapted to fulfill services in commercial and military fields. Up to now the demands of the military command were implemented in special, mostly analog communication networks. These, however, present the great disadvantage that they are not interoperable or only to a limited extent due to the different proprietary protocols used. Among all these protocols the TCP/IP protocol is evolving as the international standard for data exchange across network borders. The TCP/IP protocol used worldwide on Internet or in X.400 networks guarantees interoperability on different computer platforms irrespective of manufacturer and operating system.
Author
Communication Networks; Computer Programs; Protocol (Computers); Commercialization; Wireless Communication

20010019341 National Aerospace Lab., ICT Div., Amsterdam, Netherlands
MODERNIZING OMIS, AN OPERATIONAL AIR FORCE C2 SYSTEM, USING COTS HARDWARE AND SOFTWARE PRODUCTS
Stil, J. G., National Aerospace Lab., Netherlands; Commercial Off-the-Shelf Products in Defence Applications 'The Ruthless Pursuit of COTS'; December 2000, pp. 23-1 - 23-7; In English; See also 20010019317
Report No.(s): ISBN 92-837-1049-5; Copyright Waived; Avail: CASI; A02, Hardcopy

This paper outlines some experiences, gained with the modernization of an existing and operational air force Command and Control (C2) system using Commercial-Off-The-Shelf (COTS) hardware and software products and the adoption of standards, from a practitioners perspective. It describes examples of functional areas where requirements could be met using COTS products alone and where requirements couldn't be met and what strategies were followed to meet these requirements.
Author
Computer Programs; Technology Utilization; Commercialization; Requirements; Hardware

20010035163 North Atlantic Treaty Organization, The Hague, Netherlands
TACTICAL DATA LINKS AND INTEROPERABILITY, THE GLUE BETWEEN SYSTEMS
Hoekstra, Willem E., North Atlantic Treaty Organization, Netherlands; Systems Concepts for Integrated Air Defense of Multinational Mobile Crisis Reaction Forces; March 2001, pp. 15-1 - 15-8; In English; See also 20010035146; Original contains color illustrations; Copyright Waived; Avail: CASI; A02, Hardcopy

In this time of open system architectures, systems of various makes and origin co-operate, pass, and share pieces of information. The pieces of information, thus exchanged, should trigger the same understanding by all users Ambiguities in the translation, presentation, or interpretation of the data and information may be the cause of serious problems. This paper addresses some of the aspects of interoperability and describes ways of achieving, monitoring, and maintaining interoperability in particular for tactical data links such as Link 11 and Link 16. Emphasis is given to tactical data link interoperability with the NATO E-3A.
Author
Architecture (Computers); Data Links; Operating Systems (Computers)

20010047055 Military Technical Academy, Bucharest , Romania
USING OF FAULT TOLERANT DISTRIBUTED CLUSTERS IN THE FIELD OF COMMAND AND CONTROL SYSTEMS
Aurel, Serb, Military Technical Academy, Romania; Valeriu, Patriciu Victor, Military Technical Academy, Romania; New Information Processing Techniques for Military Systems; April 2001, pp. 12-1 - 12-10; In English; See also 20010047042; Copyright Waived; Avail: CASI; A02, Hardcopy

The open and distributed systems, that are the most important systems used in the field of command and control systems, must never fail. But only ideal system would be perfectly reliable and never fail. Fault tolerance is the best guarantee that high-confidence systems will not succumb to physical, design, or human-machine

interaction faults. A fault tolerant system is one that can continue to operate reliably by producing acceptable outputs in spite of occasional occurrences of component failures, A fault tolerant cluster is a cluster with a set of independent nodes, connected over a network and always with external storage devices connected to the nodes on a common input/output bus. The cluster software is a layer that runs on top of local operating systems running on each computer. Clients are connected over the networks to a server application that is executing on the nodes. The nodes of a cluster are connected in a loosely coupled manner, each maintaining its own separate processors, memory, and operating system. Special communications protocols and system processes bind these nodes together and allow them to cooperate to provide outstanding levels of availability and flexibility for supporting mission critical applications. One of the most important problems in implementing fault tolerant system is the identification of single points of failure and elimination of these single points of failure by using replaceable units. When a component becomes unavailable, fault tolerant cluster software detects the loss and shifts that component's workload to another component in the cluster. The failure recovery is done automatically, without any human intervention. The need for interoperability between the M&S world and the Command and Control world has been formulated in several publications. The challenge even increases when NATO and PfP Nations demands to train using their own simulation systems as well as their own command and control systems. The key issue for the Command, Control, Communications, Computers, Intelligence, Surveillance, and Reconnaissance (C41SR) community is the interoperability between live or real C41SR systems and modeling and simulation systems. Today, some of the architectural key words that are in common in the modem command and control systems and fault tolerant systems are the following: Open and distributed systems; Networks; High level operating systems; Hierarchical architecture; Interoperability and reusability; High availability systems.
Author
Fault Tolerance; Failure Analysis; Computer Networks; Cluster Analysis; Data Mining

20010047059 SACLANT Undersea Research Centre, La Spezia, Italy
WIRELESS TACTICAL NETWORKS IN SUPPORT OF UNDERSEA RESEARCH
Berni, Alessandro, SACLANT Undersea Research Centre, Italy; Mozzone, Lorenzo, SACLANT Undersea Research Centre, Italy; New Information Processing Techniques for Military Systems; April 2001, pp. 16-1 - 16-9; In English; See also 20010047042; Original contains color illustrations; Copyright Waived; Avail: CASI; A02, Hardcopy

Emerging concepts for Anti-Submarine Warfare (ASW) and Rapid Environmental Assessment (REA) increasingly rely on communication technology, in order to implement distributed information networks and to exchange information between naval units and military commands ashore. The necessary communication links could be accomplished using a variety of solutions: our main focus is on radio frequency (RF) links, which offer easy deployment and flexible operations. Requirements (such as transmission data rate) change from one specific application to another. There are however a number of prerequisites that are shared by all applications and users: they include, but are not limited to, reliability, availability and security. The biggest challenge derives from the fact that those requirements are countered by either natural factors, such as thermal noise and multipath interference, or by hostile activity aimed at disrupting the integrity of the lines of communication. This document illustrates how spread-spectrum techniques can be adopted to substitute and enhance existing communications systems, to permit the deployment of distributed, scalable networks of ships and sensors, characterized by reliable performance (resistance to hostile jamming and environmental interference) and low probability of interception. An overview of real applications in ASW and REA is presented.
Author
Telecommunication; Multipath Transmission; Communication Networks; Radio Frequencies; Spread Spectrum Transmission

20010047060 Space and Naval Warfare Systems Command, Acoustics Branch, San Diego, CA USA
TELESONAR SIGNALING AND SEAWEB UNDERWATER WIRELESS NETWORKS
Rice, J. A., Space and Naval Warfare Systems Command, USA; New Information Processing Techniques for Military Systems; April 2001, pp. 17-1 - 17-13; In English; See also 20010047042; Original contains color illustrations; Copyright Waived; Avail: CASI; A03, Hardcopy

Seawebs '98, '99, and 2000 are experiments incrementally advancing telesonar underwater acoustic signaling and ranging technology for undersea wireless networks. The constraints imposed by acoustic transmission through shallow-water channels have yielded channel-tolerant signaling methods, hybrid multi-user access strategies, novel network topologies, half-duplex handshake protocols, and iterative power-control techniques. Seawebs '98 and '99 respectively included 10 and 15 battery-powered, anchored telesonar nodes organized as noncentralized bi-directional networks. These tests demonstrated the feasibility of battery-powered, wide-area undersea networks linked via radio gateway buoy to the terrestrial internet. Testing involved delivery of remotely sensed data from the sea and remote control from manned command centers ashore and afloat. Seaweb 2000 introduces new telesonar modem hardware and a compact protocol for advanced network development. Sublinks '98, '99, and 2000 are parallel experiments that extend Seaweb networking to include a submerged submarine as a mobile gateway node.
Author
Underwater Acoustics; Control Systems Design; Acoustic Propagation; Sound Transmission; Remote Sensing

20010047061 Scientific and Technical Research Council of Turkey, Kocaeli, Turkey
THE TURKISH NARROW BAND VOICE CODING AND NOISE PRE-PROCESSING NATO CANDIDATE
Kondoz, Ahmet, Scientific and Technical Research Council of Turkey, Turkey; Palaz, Hasan, Scientific and Technical Research Council of Turkey, Turkey; New Information Processing Techniques for Military Systems; April 2001, pp. 18-1 - 18-5; In English; See also 20010047042; Copyright Waived; Avail: CASI; A01, Hardcopy

Robust and low power communication systems are essential for battle field environment in military communication which require bit rates below 4.8kb/s. In order to benefit from the new advances in speech coding technologies and hence upgrade its communication systems, the NATO has been planning to select a speech coding algorithm with its noise pre-processor. In this paper we describe a speech coder which is capable of operating at both 2.4 and 1.2kb/s, and produce good quality synthesized speech. This coder will form the basis of the Turkish candidate which is one of the three competing. The rate of the coder can be switched from 2.4kb/s to 1.2kb/s by increasing the frame length for parameter quantisation from 20ms to 60ms. Both rates use the same analysis and synthesis building blocks over 20ms. Reliable pitch estimation and very elaborate voiced/unvoiced mixture determination algorithms render the coder robust to background noise. However in order to communicate in very severe noisy conditions a noise pre-processor has been integrated within the speech encoder.
Author
Telecommunication; Narrowband; Voice Data Processing; Coders

20010047062 SACLANT Undersea Research Centre, La Spezia, Italy
DATA COMMUNICATION AND DATA FUSION IN RAPID ENVIRONMENTAL ASSESSMENT: STATE OF THE ART
Trangeled, Alex, SACLANT Undersea Research Centre, Italy; Vink, Frederik H., SACLANT Undersea Research Centre, Italy; Berni, Alessandro, SACLANT Undersea Research Centre, Italy; New Information Processing Techniques for Military Systems; April 2001, pp. 19-1 - 19-8; In English; See also 20010047042; Original contains color illustrations; Copyright Waived; Avail: CASI; A02, Hardcopy

In the evolving world of international security, NATO faces new challenges. In early 1990's the Alliance studied the new security situation and revised its strategically concept. Future conflicts will occur in a wider area of interest with lower intensity and on a regional scale; the area of operation is in many aspects unknown. An active effort is necessary to be able to combat future threats. The mission of the SACLANT Undersea Research Centre (SACLANTCEN), based in La Spezia, Italy, is to conduct research in support of NATO's maritime operational requirements. Considerable efforts are being made to identify and counter the threats related to underwater warfare. SACLANTCEN performs operations research and analysis,

research and development in the field of Anti Submarine Warfare (ASW), Mine Counter Measures (MCM) and Military Oceanography MILOC), Rapid Environmental Assessment (REA) is one of the five thrust areas of SACLANTCEN's Scientific Programme of Work (SPOW). The goal of the Centre's REA program is to research methods for providing warfighters and planners with tactical relevant information in a tactical relevant timeframe. This document concentrates on the technological aspects of data processing, fusion and transmission, illustrating the evolution of the techniques adopted and their innovative impact on MILOC activities.
Author
Data Transmission; Data Processing; Security; Operations Research; Multisensor Fusion

20010082335 Thomson-CSF Detexis, Elancourt, France
MINIMIZING THE SOFTWARE RE-DESIGN IN OBSOLESCENT RADAR PROCESSORS WITH FUNCTIONAL RADAR SIMULATION AND SOFTWARE WORKSHOP
Lacomme, Philippe, Thomson-CSF Detexis, France; Baret, Veronique, Thomson-CSF Detexis, France; Strategies to Mitigate Obsolescence in Defense Systems Using Commercial Components; June 2001, pp. 9-1 - 9-4; In English; See also 20010082326; Original contains color illustrations; Copyright Waived; Avail: CASI; A01, Hardcopy

Signal and Data Processors are the sub-assemblies which are the most likely obsolescent parts in modern airborne Radars. As their architecture is based on multiple parallel commerical off-the-shelf (COTS) processors, the implementation of the algorithms in these processors is a costly and time consuming task which represents the most significant part of the cost when the sub-assembly has to be replaced due to component obsolescence. The use of a powerful software work-shop is the way to dramatically cut the cost of the software redesign by an extended re-use policy. A significant improvement in the radar development cycle can be achieved through simulation techniques. These new tools and methodology enables to reduce costs and to shorten the radar modes development cycle. During the phase of specification, a functional radar prototype is developed, requirements are defined, and testing procedures are developed. This functional radar prototype is completely independent of the processor hardware and survives to COTS obsolescence. During the phase of on-board functional software development, the functional prototype is re-used to simulate the machine architecture (processors in parallel, communications, etc.) and the algorithms are optimized for the target processor hardware. During the testing phase, a cross test between the functional prototype and the on-board functional software can be performed by the re-use of the testing procedures. Also, the flight tests can be prepared by the simulation of the scenario to be played. The designer can be assisted by a tools for all this developments.
Author
Prototypes; Computerized Simulation; Airborne Radar

20010082345 European Aeronautic Defence and Space Co., Airborne Systems, Ulm Germany
A MODULAR SIGNAL PROCESSING ARCHITECTURE TO MITIGATE OBSOLESCENCE IN AIRBORNE SYSTEMS
Rothmaier, Markus, European Aeronautic Defence and Space Co., Germany; Strategies to Mitigate Obsolescence in Defense Systems Using Commercial Components; June 2001, pp. 21-1 - 21-8; In English; See also 20010082326; Original contains color illustrations; Copyright Waived; Avail: CASI; A02, Hardcopy

After providing an introduction to the obsolescence problem, this paper explains how the topic is handled to date, using an airborne radar system development as an example. In this, the supplier primarily reacts on obsolete components with post design measures. In contrast to this a pro-active approach is suggested that starts with defining an architecture that eases the substitution of obsolete components and allows upgrades without involving major redesigns. This includes the need to safeguard the effort spend for developing and qualifying application software. The article presents a modular structured signal processing architecture that employs commercial off-the-shelf (COTS) modules and standards. It discusses the ability of such an architecture to cope with the obsolescence problem by separating interfaces from processing units and applying COTS interface standards. Means of the designer are examined that allow to proactively design a processor that is likely to survive hardware and software component changes at minimum cost. Forming standard building blocks that encapsulate processing functions is presented as an approach that will considerably reduce the involved risk.
Author
Signal Processing; Architecture (Computers); Airborne Radar; Avionics

20010082348 Rohde and Schwartz, Radiocommunications Systems Div., Munich, Germany
SOFTWARE RADIOS FOR MAXIMUM FLEXIBILITY AND INTEROPERABILITY
Leschhorn, Ruediger, Rohde and Schwartz, Germany; Pensel, Karlheinz, Rohde and Schwartz, Germany; Strategies to Mitigate Obsolescence in Defense Systems Using Commercial Components; June 2001, pp. 24-1 - 24-7; In English; See also 20010082326; Copyright Waived; Avail: CASI; A02, Hardcopy

The upcoming Software Radios will change the commercial as well as the military market of radio communications. Due to their programmability Software Radios offer an extreme flexibility falling into three main domains: Multirole, Multimode, and Multiband operation. Multiband just means that the radio can cover the complete spectrum from HF to SHF, Multimode requests to cope with different air interfaces, and Multirole addresses the question of which applications a software radio has to serve. Essential properties of a software radio architecture, particularly supporting the use of commercial off-the-shelf (COTS) components and mitigating parts obsolescence, are the strict decoupling of application software and platform hardware (forming APIs) together with a consequent modularization of the hardware. The decoupling allows hardware-independent development of the application software, whilst the hardware modularization supports a cyclic reengineering process in case components have to be replaced by new COTS parts. Savings in term of logistic and upgrades reduce the overall life-cycle costs by about 40% in comparison with conventional radios. In turn, these platforms are free to be scaled to manpack, airborne, naval, or stationary deployment, simultaneously optimized for example in terms of power saving, size, or flexibility, where the software layer guarantees interoperability among these radio families by common waveforms. An example of an existing military software radio is presented showing multiband, multimode, and multirole features.
Author
Radio Communication; Radio Equipment; Computer Programs; Military Technology

20020016342 kk Consulting, Ottobrunn, Germany
GERMAN AIR FORCE PROCEDURES FOR IMPLEMENTING INTEROPERABLE INFORMATION SYSTEMS IN C(SUP 2), WEAPON, AND SUPPORT SYSTEMS TO SUPPORT NATO LED COMBINED JOINT TASK FORCE OPERATIONS
Kulke, Klaus, kk Consulting, Germany; Information Management Challenges in Achieving Coalition Interoperability; December 2001, pp. 15-1 - 15-3; In English; See also 20020016329; Copyright Waived; Avail: CASI; A01, Hardcopy; A03, Microfiche

This paper summarizes the German Armed Forces conclusions and activities to establish operational interoperability on future tactical data link networks with forces of other nations. It describes the steps taken by national authorities to meet this challenging goal and it describes the currently achieved status. The key conclusion is a strict application of interoperability management procedures to develop appropriate platform documents, first on a conceptual level and then, on a specification level with the subsequent implementation of interoperable platform Information Systems based on a Task Force-centric and Link Network-centric approach. The approach does consider the NATO (North Atlantic Treaty Organization) Combined Joint Task Force (CJTF) Concept and the 'New ways to do Business' as outlined in the new joint command and control philosophy within the NATO military command structure.
Author
Data Links; Information Systems; Interoperability; International Cooperation; Military Operations

20020016343 Defence Research Establishment Valcartier, Information and Knowledge Management Section, Val Belair, Quebec Canada
PERFORMANCE MANAGEMENT OF C2ISS THROUGH QOS
Dorion, Eric, Defence Research Establishment Valcartier, Canada;

Information Management Challenges in Achieving Coalition Interoperability; December 2001, pp. 16-1 - 16-8; In English; See also 20020016329; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

This paper emphasizes the importance of performance management of Command and Control Information Systems (C2ISs) in the context of a coalition. It describes some of the concepts that are being developed or used at DREV (Defence Research Establishment Valcartier) for ensuring that performance and efficiency in systems can be reproduced and improved instead of applying ad hoc solutions. The concept of Quality of Service (QoS) is adapted to our needs and key technology aspects are considered.
Author
Command And Control; Information Systems; International Cooperation

20020016346 Physics and Electronics Lab. TNO, The Hague, Netherlands
NETWORK CENTRIC OPERATIONS: IMPLICATIONS FOR ALLIED AND COALITION OPERATIONS
Keus, Hans E., Physics and Electronics Lab. TNO, Netherlands; Information Management Challenges in Achieving Coalition Interoperability; December 2001, pp. 19-1 - 19-8; In English; See also 20020016329; Original contains color illustrations; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

Network Centric Warfare (NCW) or perhaps a better term would be Network Centric Operations (NCO) is rapidly becoming one of the areas where the most likely progress in efficiency and effectiveness of military operations will take place. The benefits of information technology and specifically network technology in the civil business area are starting to become known in the military domain too. In the US a lot of attention is given to NCW to start adapting US forces to the ideas of NCO. However, little is known about how to achieve coalition-based NCO. This paper will go into some detail in discussing issues involved in Coalition-based NCO or CNCO as we will call it. After a short summary of the main issues of NCO we will try to identify some of the most important key factors involved in CNCO and discuss some of these items. Special attention will be given to concepts of interoperability. A migration path based upon the proposed methodological approach is suggested as a means to achieve CNCO.
Author
Information Systems; Interoperability; Military Operations; International Cooperation

20020016347 National Aerospace Lab., Information and Communication Technology Div., Amsterdam, Netherlands
A ROAD MAP TO THE NATO VIRTUAL ENTERPRISE
vandeVijver, Y. A. J. R., National Aerospace Lab., Netherlands; Stil, J. G., National Aerospace Lab., Netherlands; Information Management Challenges in Achieving Coalition Interoperability; December 2001, pp. 20-1 - 20-11; In English; See also 20020016329; Original contains color illuatrations; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

In this paper, information management challenges are described, and ways to achieve coalition interoperability, by defining a road map towards a NATO (North Atlantic Treaty Organization) virtual enterprise. Such an enterprise strongly supports the 'interoperable communications' target of the Defense Capabilities Initiative (DCI), launched at the NATO summit in Washington, April 1999. The building blocks of virtual enterprises will be discussed. These blocks are increasingly becoming standards, therefore allowing higher and higher levels of abstraction in interoperability. Starting from a historical example, and continuing with a Joint Warrior Interoperability Demonstration and results from a recent research program, this paper will describe the journey on the road to the NATO Virtual Enterprise. The paper will be concluded by looking forward to the goal and discuss the road towards it.
Author
Information Management; Interoperability; North Atlantic Treaty Organization (NATO)

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ELECTRONICS AND ELECTRICAL ENGINEERING

20000012195 State Research Center of the Russian Federation-Central Scientific and Research Inst. Elektropribor, Saint Petersburg, Russia
THE SYNTHESIS OF FEDERATED FILTERS BY ANALOGY WITH TRANSFORMATION OF ELECTRIC CIRCUITS, State Research Center of the Russian Federation-Central Scientific and Research Inst. Elektropribor
Tupysev, V. A., Russia; 6th Saint Petersburg International Conference on Integrated Navigation Systems; October 1999, pp. 24-1 - 24-10; In English; See also 20000012172; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

At present when navigational systems are built on a modular principle the methods of federated (distributed) filtering have found a wide application as they allow computational potentialities of measuring modules to be used at a maximum. The essence of these methods is that, first, the measurements are processed by using the bank of Kalman-type local filters realized in these modules. Further, local estimates which result from this processing come to the master filter where the best global estimates of the main navigation parameters are generated. Different approaches to the problem of synthesis and analysis of federated filters are known and a number of important practical and theoretical results have been obtained. In theory it has been established that as opposed to the centralized processing of measurements when all the measurements can be processed using only one optimal Kalman filter (measurements are assumed to be linear or linearized values), the federated filtering methods are generally suboptimal in relation to the centralized Kalman filter. The conditions for adjusting local filters have also been defined. It has been shown that the estimated covariance matrix of the estimate error generated in the master filter is an upper estimate for a real covariance matrix of the error estimate. Various types of federated filters have been analyzed, including those which use the information generated in the master filter both for resetting the local filters and for their coordination. The derivation of these and other results involves proofs based on a good mathematical background and sometimes is difficult to understand, that is why in this paper an attempt is made to illustrate the main principles of federated filtering in a simple way, namely, by using the analogy between the process of information processing and the processes typical for electric circuits.
Derived from text
Kalman Filters; Matrices (Mathematics); Circuits; Mathematical Models; Analogies

20000020830 Army Tank-Automotive and Armaments Command, Warren, MI USA
GROUND VEHICLE MOBILITY REQUIREMENTS: MEETING THE CHALLENGE WITH ELECTRIC DRIVES
Khalil, G., Army Tank-Automotive and Armaments Command, USA; Hitchcock, Jennifer, Army Tank-Automotive and Armaments Command, USA; Gas Turbine Engine Combustion, Emissions and Alternative Fuels; June 1999, pp. 1-1 - 1-13; In English; See also 20000020829; Copyright Waived; Avail: CASI; A03, Hardcopy; A06, Microfiche

Military ground vehicle requirements are defined by the terrains they traverse and the performance specifications defined by the users. While terrains have not changed much throughout the history of ground vehicles, the performance specifications have always evolved with the ever changing technologies and the threats associated with them. This paper contains a summary of current and future vehicle requirements, and the enabling technologies necessary for meeting them, including prime power sources which range from conventional engines to fuel cells. Among the various technologies under consideration for future vehicle needs, electric drive stands out as a leading candidate. Therefore, a good portion of the paper is dedicated to electric drive systems and their impact on vehicle missions; particularly mobility.
Author
Surface Vehicles; Electric Automobiles; Design Analysis; Propulsion; Functional Design Specifications

20010012834 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
COMPOUND SEMICONDUCTOR DEVICES FOR SPACE APPLICATIONS
Kayali, Sammy, Jet Propulsion Lab., California Inst. of Tech., USA; Space-Based Observation Technology; October 2000, pp. 26-1 - 26-9; In English; See also 20010012824; Copyright Waived; Avail: CASI; A02, Hardcopy

Application of semiconductor devices in high reliability space systems requires a thorough understanding of the reliability and failure mechanisms associated with the selected devices. This paper provides a description of the reliability and qualification issues related to the application of compound semiconductor devices in critical space systems. A discussion of common failure mechanisms, radiation effects and other reliability concerns is provided along with a discussion of methods for technology qualification for high reliability space applications.
Author
Semiconductor Devices; Technology Utilization; Aerospace Systems

20010082328 Defense Micro-Electronic Activity, Sacramento, CA USA
USA DEPARTMENT OF DEFENSE INITIATIVES FOR THE MANAGEMENT AND MITIGATION OF MICROELECTRONICS OBSOLESCENCE
Glum, Ted, Defense Micro-Electronic Activity, USA; Strategies to Mitigate Obsolescence in Defense Systems Using Commercial Components; June 2001, pp. K-1 - K-2; In English; See also 20010082326; Copyright Waived; Avail: CASI; A01, Hardcopy

The USA Department of Defense (US DoD) and its allies increasing rely on 'smart' weapon systems to provide both a strategic and tactical edge on the battlefield. The components that make these systems smart are the complex microelectronics devices that form the core of their functional capability. However, this same semiconductor technology upon which we rely turns over every 18 months or less and is normally supported for no more than six to seven years. Yet the US DoD and its allies keep their weapon systems in operation for ever-increasing periods of time, and often requiring the availability of 'unique' microelectronics devices for 20 or more years. Therefore, the problem facing the DoD and its allies is not the ability to acquire advanced technology during weapon system development, but rather the inability to acquire this technology during the out-years in order to keep hi-tech weapon systems supported. This emphasizes the need for the development of management techniques and solution based strategies to handle the problem of microelectronics obsolescence.
Author
Management Methods; Microelectronics; Semiconductors (Materials); Weapon Systems

20010082334 Matra BAe Dynamics, Velizy-Villacoublay, France
METHODOLOGICAL GUIDE TO ASIC DESIGN WITH DURABILITY MANAGEMENT 'COCISPER: CONCEPTION CIRCUITS INTEGRES SPECIFIQUES ET PERENNITE'
Barre, M., Matra BAe Dynamics, France; Butel, P., Matra BAe Dynamics, France; Strategies to Mitigate Obsolescence in Defense Systems Using Commercial Components; June 2001, pp. 8-1 - 8-7; In English; See also 20010082326; Original contains color illustrations; Copyright Waived; Avail: CASI; A02, Hardcopy

The military sector is characterized by specific aspects such as small series, high reliability, long life-cycle products. In this context, the DGA wished to set up means to develop specific integrated circuits for the durability of electronic systems. Thus, in 1995, a first COCISPER contract has been awarded to a Consortium fully representative of the industry in France. It is aimed to establish a methodology guide for designing Application Specific Integrated Circuits (ASIC) taking into account the needs for system durability. Therefore, it defines an industrial standard following the withdrawal of mil-spec ones. The guide produced within this project specifies the general development plan of numeric integrated circuits at the ASIC design process level, but also at the equipment and system specification, validation and qualification stages. It proposes recommendations applicable to the whole industry. A follow-up study has been awarded to the same Consortium in 1998 which aims at experimenting and validating the COCISPER guide on real applications, but also at updating it to take into account the Programmable Logic Devices (PLD) and recent techniques such as the use of Virtual Components. In addition, an evolution of the guide facilitating the access to information has been asked. A HMTL version is now developed and available.
Author
Application Specific Integrated Circuits; Durability

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FLUID MECHANICS AND THERMODYNAMICS

19990052868 Research and Technology Organization, Applied Vehicle Technology Panel, Neuilly-sur-Seine, France
HIGH ORDER APPROXIMATIONS FOR COMPRESSIBLE FLUID DYNAMICS ON UNSTRUCTURED AND CARTESIAN MESHES
Barth, Timothy, Editor, NASA Ames Research Center, USA; Deconinck, Herman, Editor, Von Karman Inst. for Fluid Dynamics, Belgium; March 1999; 582p; In English; Higher Order Discretization Methods in Computational Fluid Dynamics; 14-15 Sep. 1998, Rhode-Saint-Genese, Belgium; 21-25 Sep. 1998, Moffett Field, CA, USA; Sponsored by Research and Technology Organization, France
Report No.(s): RTO-EN-5; ISBN 3-540-65893-9; Copyright; Avail: Issuing Activity, Hardcopy

The development of high-order accurate numerical discretization techniques for irregular domains and meshes is often cited as one of the remaining challenges facing the field of computational fluid dynamics. In structural mechanics, the advantages of high-order finite element approximation are widely recognized. This is especially true when high-order element approximation is combined with element refinement (h-p refinement). In computational fluid dynamics, high-order discretization methods are infrequently used in the computation of compressible fluid flow. The hyperbolic nature of the governing equations and the presence of solution discontinuities makes high-order accuracy difficult to achieve. Consequently, second-order accurate methods are still predominately used in industrial applications even though evidence suggests that high-order methods may offer a way to significantly improve the resolution and accuracy for these calculations. To address this important topic, a special course was jointly organized by the Applied Vehicle Technology Panel of NATO's Research and Technology Organization (RTO), the von Karman Institute for Fluid Dynamics, and the Numerical Aerospace Simulation Division at the NASA Ames Research Center. The NATO RTO sponsored course entitled 'Higher Order Discretization Methods in Computational Fluid Dynamics' was held September 14-18, 1998 at the von Karman Institute for Fluid Dynamics in Belgium and September 21-25, 1998 at the NASA Ames Research Center in the USA. During this special course, lecturers from Europe and the USA gave a series of comprehensive lectures on advanced topics related to the high-order numerical discretization of partial differential equations with primary emphasis given to computational fluid dynamics (CFD). Additional consideration was given to topics in computational physics such as the high-order discretization of the Hamilton-Jacobi, Helmholtz, and elasticity equations. This volume consists of five articles prepared by the special course lecturers. These articles should be of particular relevance to those readers with an interest in numerical discretization techniques which generalize to very high-order accuracy. The articles of Professors Abgrall and Shu consider the mathematical formulation of high-order accurate finite volume schemes utilizing essentially non-oscillatory (ENO) and weighted essentially non-oscillatory (WENO) reconstruction together with upwind flux evaluation. These formulations are particularly effective in computing numerical solutions of conservation laws containing solution discontinuities. Careful attention is given by the authors to implementational issues and techniques for improving the overall efficiency of these methods. The article of Professor Cockburn discusses the discontinuous Galerkin finite element method. This method naturally extends to high-order accuracy and has an interpretation as a finite volume method. Cockburn addresses two important issues associated with the discontinuous Galerkin method: controlling spurious extrema near solution discontinuities via 'limiting' and the extension to second order advective-diffusive equations (joint work with Shu). The articles of Dr. Henderson and Professor Schwab consider the mathematical formulation and implementation of the h-p finite element methods using hierarchical basis functions and adaptive mesh refinement. These methods are particularly useful in computing high-order accurate solutions containing pertur-

bative layers and corner singularities. Additional flexibility is obtained using a mortar FEM technique whereby nonconforming elements are interfaced together. Numerous examples are given by Henderson applying the h-p FEM method to the simulation of turbulence and turbulence transition.
Derived from text
Computational Fluid Dynamics; Partial Differential Equations; Discretization (Mathematics); Approximation; Unstructured Grids (Mathematics); Galerkin Method; Essentially Non-Oscillatory Schemes; Weighting Functions

19990053145 Southampton Univ., UK
CFD PREDICTIONS OF THE INFLUENCE OF EXTERNAL AIR-FLOW ON HELICOPTER OPERATIONS WHEN OPERATING FROM SHIP FLIGHT DECKS
Wakefield, N. H., Southampton Univ., UK; Newman, S. J., Southampton Univ., UK; Wilson, P. A., Southampton Univ., UK; Fluid Dynamics Problems of Vehicles Operating Near or in the Air-Sea Interface; February 1999, pp. 2-1 - 2-10; In English; See also 19990053143; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

A CFD model of a hovering helicopter main rotor is developed to examine airflow in the presence of ship structures and side winds. The rotor is modelled by modifying the governing Navier-Stokes equations in the region of the disc. The extra terms added to the governing equations apply a downforce to the fluid; these forces are independent of the flow around the rotor and equal to the helicopter weight. The boundaries of the computational domain are also modified in order to generate a physically correct solution. Flow solutions in both two and three dimensions are achieved using the commercial flow solver CFX 4.1. The flow solutions exhibit very good correlation with established momentum and power principles. In order to model helicopter operations from a ship's flight deck, typically a frigate, the rotor is modelled at several positions above a ship profile. Cross winds are applied to the computational domain. The thrust of the rotor is held constant and the resulting flow solutions are calculated. The power exerted at the rotor is obtained and compared to the ideal hover condition and computational flow solution. The flow solutions show that the airflow accelerates over the flight deck and a helicopter operating in this region encounters large cross winds and velocity gradients. The results also show that the helicopter control margins are more likely to limit the safe operating limit than the power margin. Using the modified boundary conditions, this method demonstrates the viability of CFD for predicting the ship airwake and the reduced power margins a helicopter experiences whilst operating in the vicinity of the ship. This study has been exploratory and limited by computing resources, but future models will include helicopter fuselage, tail rotor, time dependent boundary conditions and dynamic flight.
Author
Helicopter Control; Computational Fluid Dynamics; Navier-Stokes Equation; Mathematical Models; Loads (Forces); Boundary Conditions; Predictions; Rotary Wings

19990053146 Pennsylvania State Univ., Dept. of Aerospace Engineering, University Park, PA USA
HIGHER ORDER ACCURATE SOLUTIONS OF SHIP AIRWAKE FLOW FIELDS USING PARALLEL COMPUTERS
Long, Lyle N., Pennsylvania State Univ., USA; Liu, Jingmei, Pennsylvania State Univ., USA; Modi, Anirudh, Pennsylvania State Univ., USA; Fluid Dynamics Problems of Vehicles Operating Near or in the Air-Sea Interface; February 1999, pp. 3-1 - 3-14; In English; See also 19990053143
Contract(s)/Grant(s): N00014-97-1-0530; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

This paper presents a new method for simulating ship airwake flow fields. These flows are inherently unsteady, and very difficult to predict. The method presented (NLDE) is fourth-order accurate in space and time. In this method we first solve for the steady state flow field, then we solve for the unsteady fluctuations. Steady and unsteady results are presented for a generic frigate shape. Considering the complex geometry of real ship. the unstructured grid approach is most useful. The mean flow results are compared with oil flow visualization photographs. Parallel computational methods are a necessity for ship air wake problems and MPI is used in the NLDE solver. The parallel performance on various computers is presented also.
Author
Ships; Unsteady Flow; Flow Visualization; Wakes; Flow Distribution; Computerized Simulation; Parallel Processing (Computers)

19990053147 Naval Surface Warfare Center, Carderock Div., Bethesda, MD USA
SIMULATION AND ANALYSIS OF LHD SHIP AIRWAKE BY NAVIER-STOKES METHOD
Tai, Tsze C., Naval Surface Warfare Center, USA; Fluid Dynamics Problems of Vehicles Operating Near or in the Air-Sea Interface; February 1999, pp. 4-1 - 4-10; In English; See also 19990053143; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

A multi-zone, thin-layer Navier-Stokes method is utilized to investigate the airwake about an LHD ship configuration. This ship's superstructure is modelled with blocked structures that closely represent the actual geometry. The freestream has a wind speed of 12.87 m/s (25 knots) at a direction of zero, 10 and 20 degrees. The flow is fully turbulent with a Reynolds number of 221 million based on ship length. In general, the flow is largely separated behind the superstructure. Major flow features including viscous-vortex interactions observed experimentally are captured in the simulation. Typical results in the form of particle traces and the velocity field over and aft of the ship are presented.
Author
Navier-Stokes Equation; Ships; Wind Velocity; Velocity Distribution; Free Flow; Computerized Simulation; Flow Visualization

19990053148 Defence Evaluation Research Agency, Aero/Structures Dept., Farnborough, UK
PREDICTION OF SHIP AIR WAKES OVER FLIGHT DECKS USING CFD
Tattersall, P., Defence Evaluation Research Agency, UK; Albone, C. M., Defence Evaluation Research Agency, UK; Soliman, M. M., Defence Evaluation Research Agency, UK; Allen, C. B., Bristol Univ., UK; Fluid Dynamics Problems of Vehicles Operating Near or in the Air-Sea Interface; February 1999, pp. 5-1 - 5-12; In English; See also 19990053143; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

A Computational Fluid Dynamics (CFD) method is presented for calculating the airflow over a ship superstructure, with emphasis on the flow over aft-located helicopter decks on conventional naval ships. The non-aligned grid generation and flow solution methods are described, including discussion of the modelling of time-accuracy and rotor downwash effects. Work on the coupling of the CFD results with a rotor performance code (CRFM) is also described. Example solutions are shown to illustrate the current capabilities of the method.
Author
Computational Fluid Dynamics; Ships; Wakes; Air Flow; Rotors

19990053150 Institute for Aerospace Research, Aerodynamics Lab., Ottawa, Ontario Canada
ANALYSIS OF PATROL FRIGATE AIR WAKES
Zan, S. J., Institute for Aerospace Research, Canada; Syms, G. F., Institute for Aerospace Research, Canada; Cheney, B. T., Institute for Aerospace Research, Canada; Fluid Dynamics Problems of Vehicles Operating Near or in the Air-Sea Interface; February 1999, pp. 7-1 - 7-14; In English; See also 19990053143; Original contains color illustrations; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

The operation of helicopters from a ship-based platform is a challenging procedure from a pilot's perspective. In addition to maneuvering near a moving platform, the pilot must respond to the complex, unsteady flow field which exists over the flight deck. The flow over the ship superstructure generates an air wake which contains significant spatial gradients in the mean wind velocities as well as increased turbulence levels; both may significantly alter the performance of an immersed helicopter rotor. To address this issue completely, one must deal with a fully-coupled problem including both the helicopter rotor and the ship air wake. However, as a first step, the ship air wake can be mapped out to estimate what inflow the rotor might experience. A program is under way in the National Research Council of Canada Aerodynamics Laboratory (NRC/AL) to analyze the air wake formed behind the Halifax-Class Patrol Frigate

(CPF). It contains an experimental component and a computational one. Using hot-film anemometers and the AL 5m Vertical Wind Tunnel, the experimental element maps out the flow field (14x13x16 matrix) in the vicinity of the flight deck of a 1:50 scale CPF model at 0 deg yaw and 12 deg yaw. The region measured included the boundaries of the recirculation zone that exists behind the hangar. An atmospheric boundary layer profile was created by placing a set of horizontal rods upstream of the model, which generated a properly scaled variation of mean velocity with height. To complement this work the flow field around a modified CPF was computed using a Navier-Stokes flow solver. This modification exists for these experiments only. No such modifications exists on the real ships. In order to facilitate grid generation, simplifications were made to the bridge and several of the smaller structures around the flight deck were removed. A structured, multi-block, pressure-based Navier-Stokes flow solver was used to compute the steady-state flow field. The atmospheric boundary layer was included in the numerical simulation. This modified ship geometry was also placed in the wind tunnel for validation of the numerical solutions. The results of the wind tunnel experiments show the recirculating zone behind the hangar as well as the asymmetries in the flow field caused by a 20 mm Phalanx CIWS found on the starboard roof of the hangar. The numerical results agree favourably with the modified CPF experimental results and give further details of the air wake.
Author
Wakes; Numerical Analysis; Flow Distribution; Steady State; Unsteady Flow; Atmospheric Boundary Layer; Navier-Stokes Equation; Rotary Wings; Wind Velocity

19990053151 Defence Evaluation Research Agency, Flight Management and Control Dept., Bedford, UK
MODELLING AND SIMULATION OF SHIP AIR WAKES FOR HELICOPTER OPERATIONS: A COLLABORATIVE VENTURE
Wilkinson, C. H., Defence Evaluation Research Agency, UK; Zan, S. J., Institute for Aerospace Research, Canada; Gilbert, N. E., Defence Science and Technology Organisation, Australia; Funk, J. D., Naval Air Warfare Center, USA; Fluid Dynamics Problems of Vehicles Operating Near or in the Air-Sea Interface; February 1999, pp. 8-1 - 8-12; In English; See also 19990053143; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

The development of simulation for application to the helicopter-ship dynamic interface has been an activity under an international collaborative panel of The Technical Co-operation Programme since 1990. Modelling the ship air wake and its effect on the helicopter behaviour is regarded by the panel as one of the most significant technical challenges. Increasing the fidelity in this area can enhance the effectiveness of simulation in research, qualification and training, and open up opportunities to predict and correct for 'troublespots' in the design of new ships. A number of approaches are being pursued concurrently aimed at applying Computational Fluid Dynamics and other, more empirical, analyses to achieve a modelling capability. All participants in the collaboration are also actively involved with conducting full- and model-scale testing to gain an improved understanding of the key features of the air wake topology and to develop a validation database. This paper details the collaborative efforts being pursued by the member nations, under the coordination of the authors. It summarises the work being conducted and draws together the various research aspects and validation tests. The aim is to present a comprehensive and co-ordinated approach to modelling and simulation of the air wake problem at the dynamic interface, putting into an operational context the more technical aspects to be discussed elsewhere in the Symposium. The paper demonstrates the application of air wake prediction in ship and aircraft design, and the value of air wake simulation in research and training.
Author
Computational Fluid Dynamics; Wakes; Ships; Aircraft Design; Computerized Simulation

19990053152 Tsentralni Aerogidrodinamicheskii Inst., Moscow, USSR
THE EXPERIENCE OF AERODYNAMIC DISTURBANCES RESEARCH BEHIND AN AIRCRAFT-CARRIER SHIP WITH ELEMENTS FOR SAFE OPERATION OF SHIP-BASED AIRCRAFT
Maslov, L. A., Tsentralni Aerogidrodinamicheskii Inst., USSR; Valuev, N. O., Tsentralni Aerogidrodinamicheskii Inst., USSR; Zharinov, A. V., Tsentralni Aerogidrodinamicheskii Inst., USSR; Fluid Dynamics Problems of Vehicles Operating Near or in the Air-Sea Interface; February 1999, pp. 9-1 - 9-6; In English; See also 19990053143; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

A opinion about some reasons of relatively late appearance of the first aircraft carrier in the Soviet Navy is expressed. TsAGI's works for provision of aerodynamic compatibility of ship-based aircraft and carrier are described. The works were directed on development of methodology of estimation of wind flow disturbances over flight deck and behind carrier by model experiment in wind tunnel. Its aim was design and realization of measures of reduction of these disturbances and its gradients up to level required for takeoff landing operation safety. Numerous model tests of different ship architecture variants allowed to study the mechanism of flow formation and to estimate the effects of motion ship kinematic parameters relative to wind and of some features of ship architecture on the flow structure. Some recommendations were developed and created on aircraft-carrier cruiser 'Minsk' for deck flow leveling. The range of relative wind angles was determined for safe landing on carrier 'Admiral Kuznetsov'.
Author
Aircraft Carriers; Aerodynamics; Takeoff; Ships; Kinematics

19990053153 Bombardier Services Corp., Dynamics Interface Program, Arlington, VA USA
SIMULATION TOOLS IN THE CALCULATION OF AIRCRAFT-SHIP INTERFACE OPERATIONAL LIMITS *[APPLICATION DES OUTILS DE SIMULATION POUR LE CALCUL DES LIMITES OPERATIONNELLES DE L'INTERFACE DYNAMIQUE AERO-NEF-NAVIRE]*
deFerrier, Bernard, Bombardier Services Corp., USA; Langlois, Bernard, Bombardier, Inc., Canada; Fluid Dynamics Problems of Vehicles Operating Near or in the Air-Sea Interface; February 1999, pp. 10-1 - 10-12; In English; See also 19990053143; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

Helicopters operating from small ships are limited in the maritime environment by high winds and rough seas. In addition, man-made obstacles, such as, hangar wall generated turbulence, ship stack hot gas motor ingestion, inappropriate deck lighting and markings limit helicopters. Dynamic Interface (DI) is defined as the study of the relationship between an air vehicle and a moving platform. It is performed to reduce risks and maximize operational flexibility. Countries with a large number of platforms conduct DI testing as a matter of necessity. An analytic approach to helicopter/ship dynamic interface testing is presented. A brief synopsis of the theory and calculation of the ship motion simulation program is presented. The Ship Motion Simulation (SMS) model is derived from the relationship between the wave and ship motion spectrum. It incorporates seakeeping philosophy and applies various definitions of seaway spectral formulation. SMS defines a seaway, computes the hydrodynamic and hydrostatic forces imposed on a ship (defined as the product of its transfer function and the seaway) and calculates a resulting ship time history. The simulation is an extensive treatment of a floating object's response to the dynamic loads on its structure. The application of ship motion simulation as a developmental operational tool is introduced. The primary application of the SMS is in operational simulation such as aircraft launch and recovery; deck handling; and flight readiness or availability. The Aircraft/Ship Interface Simulation (DI) is a mathematical description of conditions limiting the availability of an air vehicle. Factors affecting an air vehicle on a moving platform are primarily ship motion; wind-over-deck; ship airwake turbulence; and deck conditions (wet, dry, oily obstructed, etc). Sample helicopter/ship interface operational limits or envelopes are discussed. Spin-off projects into other field of growth, such as visual aids, are developed.
Author
Computerized Simulation; Motion Simulation; Helicopters; Ships; Operational Problems; Wind Velocity; Sea Roughness

19990053155 Technische Univ., Ship Hydromechanics Lab., Delft, Netherlands
MOTIONS AND ADDED RESISTANCE DUE TO WAVES OF SURFACE EFFECT SHIPS
Moulijn, Joost C., Technische Univ., Netherlands; Fluid Dynamics Problems of Vehicles Operating Near or in the Air-Sea Interface; February 1999, pp. 12-1 - 12-10; In English; See also 19990053143; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

This paper presents a computational method for motions and

added resistance due to waves of Surface Effect Ships. The computed added resistance only includes the added resistance of the air cushion. This added resistance component was believed to be the largest. The results of the computational method are compared to experimental results of MARIN and to results of new experiments which are carried out at the Ship Hydrodynamics Laboratory of Delft University of Technology. The computed motions and cushion excess pressures agree well with the MARIN results. The computed added resistance is however much smaller than the added resistance that was measured by MARIN. This discrepancy was the major reason for the new experiments. The aim of the new experiments is to get insight into the magnitude and origin of added resistance of SESs. The new experiments are still in progress at the time this paper had to be delivered. This paper presents therefore only some first results of these experiments. The new experiments show that the added resistance of the air cushion is not large. The new results for added resistance are reasonable agreement with the computational results.
Author
Surface Effect Ships; Ground Effect Machines; Computation; Experiment Design

19990053156 Norwegian Univ. of Science and Technology, Dept. of Marine Hydrodynamics, Trondheim, Norway
COBBLESTONE EFFECT ON SES
Ulstein, Tore, Norwegian Univ. of Science and Technology, Norway; Faltinsen, Odd M., Norwegian Univ. of Science and Technology, Norway; Fluid Dynamics Problems of Vehicles Operating Near or in the Air-Sea Interface; February 1999, pp. 13-1 - 13-10; In English; See also 19990053143; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

Wave induced vertical accelerations (cobblestone oscillations) of a SES (Surface Effect Ships) in small sea states is studied. Resonant spatially uniform and nonuniform dynamic cushion variations are then important. A nonlinear time domain solution is used. The nonlinearities are mainly due to the flexible stern seal bag behaviour. It is demonstrated that both the spatially varying pressure underneath the flexible stern seal bag and the impact between the bag and the water are important for the vertical accelerations of the vessel. The influence of main parameters characterizing the stern seal bag is discussed.
Author
Surface Effect Ships; Operational Problems; Afterbodies; Hydrodynamics; Dynamic Characteristics

19990053159 Istituto Nazionale di Studi Espe Architettura Navale, Italian Ship Model Basin, Rome, Italy
UNSTEADY FLOW AROUND A HYDROFOIL BENEATH WAVES
Bulgarelli, U. P., Istituto Nazionale di Studi Espe Architettura Navale, Italy; Greco, M., Istituto Nazionale di Studi Espe Architettura Navale, Italy; Landrini, M., Istituto Nazionale di Studi Espe Architettura Navale, Italy; Lugni, C., Istituto Nazionale di Studi Espe Architettura Navale, Italy; Fluid Dynamics Problems of Vehicles Operating Near or in the Air-Sea Interface; February 1999, pp. 16-1 - 16-12; In English; See also 19990053143; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

A general model for studying the unsteady free surface flow generated by a hydrofoil moving beneath a wavy free surface is presented. The flow field is assumed irrotational everywhere except for a think wake shed from the trailing edge. A boundary integral formulation for the velocity field is introduced and integral equations for the unknown velocity components are solved by an accurate as well as efficient method. The solution is stepped forward in time by evolution equations for the free surface and the wake. Test cases are solved for which experimental results are available. Both foils with and without angle of attack are considered and experimental wave profiles are successfully recovered. Drag and pressure coefficients on the hydrofoil satisfactorily compare with the experiments. The ability to handle highly nonlinear behaviors of the free surface is shown by computing breaking waves generated by a foil slightly immersed with a large angle of attack.
Author
Hydrofoils; Hydrofoil Craft; Hydroplanes (Vehicles); Unsteady Flow; Inviscid Flow; Flow Distribution; Hydrodynamics; Mathematical Models

19990053160 Academy of Sciences of the Ukraine, Inst. of Mathematics, Machines and Systems Problems, Kiev, Ukraine
HYDRODYNAMIC CHARACTERISTICS OF RUDDERS OPERATING IN AIR-SEA INTERFACE
Savchenko, V. T., Academy of Sciences of the Ukraine, Ukraine; Fluid Dynamics Problems of Vehicles Operating Near or in the Air-Sea Interface; February 1999, pp. 17-1 - 17-10; In English; See also 19990053143; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

Results of experiments with a series of rectangular and triangular (in plane) foils are described. These foils have a wedge profile and function nearly as a solid body. Three conditions of flow around the foil were being guaranteed: a continuous, a cavitating and continuous with a gas-liquid layer (Gll) at the body. The research permitted us to find some effects and to design a special foil operating effectively at the body with a gas layer.
Author
Hydrodynamics; Cavitation Flow; Unsteady Flow; Hydrodynamic Coefficients; Aerodynamic Characteristics

19990053169 California Univ., Ocean Engineering Lab., Santa Barbara, CA USA
ON THE PREDICTION OF NONLINEAR FREE-SURFACE FLOWS PAST SLENDER HULLS USING 2D + T THEORY: THE EVOLUTION OF AN IDEA
Fontaine, E., California Univ., USA; Tulin, M. P., California Univ., USA; Fluid Dynamics Problems of Vehicles Operating Near or in the Air-Sea Interface; February 1999, pp. 26-1 - 26-10; In English; See also 19990053143; Sponsored in part by the French Navy; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

The basis, evolution and applications of the 2D + t nonlinear slender body theory are described through a review of the literature. Attention is focussed on practical problems, where nonlinearities, such as spray and wave breaking, play an important role. Examples of computations are provided to illustrate the capability of the method.
Author
Free Flow; Slender Bodies; Hulls (Structures); Flow Theory

19990053170 Kiev Univ., Dept. of Cybernetics, USSR
THE COMPLEX BOUNDARY INTEGRAL EQUATION METHOD FOR A PROBLEM OF ENTRY OF A 2D SOLID BODY IN AN INCOMPRESSIBLE LIQUID
Cherniy, Dmytro I., Kiev Univ., USSR; Fluid Dynamics Problems of Vehicles Operating Near or in the Air-Sea Interface; February 1999, pp. 27-1 - 27-6; In English; See also 19990053143; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

The aim of this paper is extension of complex boundary integral equations method for non-linear non-stationary problems, in which appearance of separation and accumulative effects is taken into account. The problem of heavy liquid movement in a domain with moving boundary is considered as two-dimensional and non-stationary. Properties of some boundary elements can be altered, under change of boundary conditions. The boundary contour is not already the current line and can be deformed: it does not always consist of the same liquid particles but is filled by new ones. Non-linear initial boundary value problems is confined to finding the changing with respect to time, complex potential of velocities under given initial conditions in the deforming domain D.
Author
Boundary Integral Method; Integral Equations; Incompressible Fluids

19990053171 Institut de Mecanique des Fluides de Lille, Dept. d'Aerodynamique Appliquee, France
EVOLUTION OF THE BASE BUBBLE AND RETRACTABLE JETS BEHIND AN IMMERSED LAUNCHED PROJECTILE ***[EVOLUTION DE LA BULLE DE CULOT ET JETS RENTRANTS DERRIERE UN PROJECTILE LANCE EN IMMERSION]***
Paquet, J. B., Institut de Mecanique des Fluides de Lille, France; Flodrops, J. P., Institut de Mecanique des Fluides de Lille, France; Dyment, A., Lille Univ., France; Fluid Dynamics Problems of Vehicles Operating Near or in the Air-Sea Interface; February 1999, pp. 28-1 - 28-12; In French; See also 19990053143; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

Predicting base bubble behavior during an underwater launch

of a projectile is a complex problem: it involves non-fixed free surface flow, coupled with thermodynamic effects linked to hot and condensable pressurizing gases. First, a hydrodynamic model of bubble necking, already published, is discussed in relation to recent results. Assimilation of the bubble with a launched body provides the essential similarity parameters and allows for an initial numerical estimation up to the closing of the bubble. Second, a decomposition of the thermodynamic phenomena based on modeling and numerical calculation shows that mass condensation leads to an almost-polytropic variation in the gas pressure whereas the minor influence of condensation in the wall must be respected on a small scale. Third, the most recent improvements on the installation developed at Institute of Fluid Mechanics (IMFL) are presented. The latter allow one to see, under representative real conditions, the retractable jets and to measure the pressures and loads caused by their impact on the projectile. These results are not yet accessible via calculation.
Author
Bubbles; Projectiles; Retractable Equipment; Sea Launching; Free Flow; Submerging; Fluid Mechanics

19990053172 Academy of Sciences of the Ukraine, Inst. of Hydromechanics, Kiev, Ukraine
UNDISTURBED MOTION OF VEHICLES IN THE FLUID
Savchenko, Y. N., Academy of Sciences of the Ukraine, Ukraine; Fluid Dynamics Problems of Vehicles Operating Near or in the Air-Sea Interface; February 1999, pp. 29-1 - 29-10; In English; See also 19990053143; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

The purpose of this work consists in searching such body shapes and such ways of the motion creation under which the disturbances of the velocity and pressure fields be absent or, at least, will be reduced to some minimum outside some control volume enclosing the moving body. The undisturbed motion will be named such a motion, when in each point of some closed finite control surface the disturbances induced by the body motion are equal to zero. According to the principle of maximum the disturbance outside this control surface will be equal to zero too. Two main schemes of undisturbed motion 'Body in channel' and 'body with channel' were considered theoretically and experimentally. It was shown that the system of surface waves disappeared and wave drag was absent when models moved near the free surface of water.
Author
Velocity Distribution; Pressure Distribution; Free Flow; Fluid Mechanics

19990102975 Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Inst. for Propulsion Technology, Cologne, Germany
DOPPLER GLOBAL VELOCIMETRY
Roehle, Ingo, Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; Planar Optical Measurement Methods for Gas Turbine Components; September 1999, pp. 4-1 - 4-22; In English; See also 19990102970; Original contains color illustrations; Copyright Waived; Avail: CASI; A03, Hardcopy; A02, Microfiche; US Distribution and Sales Only

This text accompanies two lectures about a relatively new planar laser measurement technique which is mostly known under the name Doppler Global Velocimetry (DGV). Doppler Global Velocimetry is an imaging anemometer. Fir.st the text will describe the basic idea of DGV. Next, the DGV system, which was sct up in the Institute of Propulsion Technology will he described in detail as well as the experimental experiences which were gained in practical applications. It is a system optimized for time averaged three component velocity measurements. The text will also show a variety of applications, a short accuracy analysis of DGV and a comparison between DGV and PIV. By know there are also two other names for DGV used in the recent literature. One is Planar Doppler Velocimetry (PDV), the other one its Global Doppler Velocimetry (GDV). The DGV technique was invented hy H. Komine at Northrop Research Center. J Meyers from NASA Langley was the first scientist picked up this idea and turned it into a usable tool for aerodynamic research. It was also him who named the technique DGV. Therefor the author will stick to this name.
Author
Velocity Measurement; Particle Image Velocimetry; Imaging Techniques; Procedures

19990102977 Rouen Univ., France
PLANAR LASER INDUCED FLUORESCENCE FOR INVESTIGATION OF SCALARS IN TURBULENT REACTING FLOWS
Stepowski, D., Rouen Univ., France; Planar Optical Measurement Methods for Gas Turbine Components; September 1999, pp. 6-1 - 6-18; In English; See also 19990102970; Original contains color illustrations; Copyright Waived; Avail: CASI; A03, Hardcopy; A02, Microfiche; US Distribution and Sales Only

The basic principles of Laser Induced Fluorescence are described with progressive presentation of simple and multi-level interaction schemes providing the relationship between the fluorescence signal and the local concentration of the investigated species in the laser field. Essential differences between Laser Induced Fluorescence and flame Chemiluminescence emissions are given. Techniques for imaging in the Planar LIF configuration and procedures for calibration of the fluorescence intensity in absolute concentration values are described. Then, examples of imaging applications are given for instantaneous mapping of OH, CH, O2, and temperature fields in turbulent reacting flows. In spite of uncertainties mainly due to collisional quenching effects, these imaging experiments are useful to ted the interaction processes involved in turbulent combustion especially when several quantities can be simultaneously or conditionally registered.
Author
Scalars; Laser Induced Fluorescence; Turbulent Flow; Transferred Electron Devices; Imaging Techniques; Chemiluminescence

20000020812 Rolls-Royce Ltd., Technology Dept., Derby, UK
PART SPEED FLUTTER OF TRANSONIC FANS
Chew, J. W., Rolls-Royce Ltd., UK; Hamby, R. J., Rolls-Royce Ltd., UK; Marshall, J. G., Rolls-Royce Ltd., UK; Vahdati, M., Imperial Coll. of Science Technology and Medicine, UK; Design Principles and Methods for Aircraft Gas Turbine Engines; February 1999, pp. 26-1 - 26-10; In English; See also 20000020789; Original contains color illustrations; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

Until recently, only rudimentary methods have been available to assess designs for susceptibility to part speed flutter, but progress is now being made with more advanced CFD-based models. Earlier work has shown that coupled structural-fluid, non-linear methods may usefully be applied to this problem, but have also indicated that more computationally efficient linear methods have a role. One such linear approach is described in this paper and demonstrated on two research fans, representative of civil and military engines. Calculations are consistent with experimental observations in that the civil fan was found susceptible to flutter while the military fan was not. The results confirm the utility of the linear approach and give further insight into the physics of this type of flutter.
Author
Computational Fluid Dynamics; Mathematical Models; Turbofans; Transonic Flutter

20000020838 Middle East Technical Univ., Chemical Engineering Dept., Ankara, Turkey
A NOVEL CODE FOR THE PREDICTION OF TRANSIENT FLOW FIELD IN A GAS TURBINE COMBUSTOR SIMULATOR
Selcuk, Nevin, Middle East Technical Univ., Turkey; Oymak, Olcay, Babcock and Wilcox Gama Boiler Technology, Inc., Turkey; Gas Turbine Engine Combustion, Emissions and Alternative Fuels; June 1999, pp. 11-1 - 11-10; In English; See also 20000020829; Copyright Waived; Avail: CASI; A02, Hardcopy; A06, Microfiche

In the present paper, numerical simulation of time-dependent two dimensional Navier-Stokes equations for incompressible separated internal flow was carried out by using the method-of-lines approach in conjunction with (1) an intelligent higher-order spatial discretization scheme, (2) a parabolic algorithm for the computation of pressure, and (3) an elliptic grid generator using body-fitted curvilinear coordinate system for application to complex geometries. The proposed code was applied to predict the time development of turbulent, cold flow in a gas turbine combustor simulator. Predictions were found to be in reasonable agreement with measured data. The

code provides an algorithm for future direct numerical simulation applications.
Author
Gas Turbines; Combustion Chambers; Combustion; Incompressible Flow; Navier-Stokes Equation; Turbulent Flow; Unsteady Flow; Computational Grids; Applications Programs (Computers); Air Flow; Cold Gas

20000020840 Office National d'Etudes et de Recherches Aerospatiales, Paris, France
NUMERICAL SIMULATION OF THE REACTIVE FLOW IN A TUBULAR CHAMBER WITH DETAILED KINETIC EFFECTS
Zamuner, B., Office National d'Etudes et de Recherches Aerospatiales, France; Bourasseau, B., Office National d'Etudes et de Recherches Aerospatiales, France; Berat, C., Turbomeca S.A. - Brevets Szydlowski, France; Niemann, H., Heidelberg Univ., Germany; Gas Turbine Engine Combustion, Emissions and Alternative Fuels; June 1999, pp. 13-1 - 13-12; In English; See also 20000020829; Copyright Waived; Avail: CASI; A03, Hardcopy; A06, Microfiche

Numerical simulation of turbulent flows in gas turbine combustors plays today a major role in the design of new concepts of combustion chambers. Indeed, the enforcement of strict environmental regulations urges gas turbine manufacturers to find out new solutions in order to reduce pollutants emissions. Lean premixed injection seems to be a promising way, but it poses the problem of flame stability induced by non extremely fast chemically controlled reaction rates. In the present study. kinetic effects are incorporated in the turbulent CFD simulations of a methane/air tubular chamber developed at TURBOMECA by means of an original approach. First, a classical numerical code (DIAMANT), which solves the 3D Reynolds Averaged Navier Stokes (RANS) equations with an algebraic fast chemistry combustion model, is used to compute the main features of the mean flow. Then, a more sophisticated turbulent combustion model, called PEUL+ (Probabilistic Eulerian-Lagrangian) model, is coupled with the RANS solver in order to account for detailed kinetic effects. The PEUL+ model consists in solving the joint probability density function (PDF) transport equation by a Monte Carlo technique. This approach has the great advantage of directly taking into account, without modelling, chemical source terms coming from detailed kinetic mechanisms for fuel oxidation. To avoid CPU expensive computations, chemical source terms are evaluated, in this work, by an Intrinsic Low Dimensional Manifold (ILDM) technique, a new interesting tabulation method which keeps the complex behaviour of a detailed kinetic system, while describing its dynamics with only two or three progress variables. The PEUL+ model with the ILDM table for methane-air mixture is applied to the tubular chamber at atmospheric pressure. Results are compared with infinitely fast combustion model simulations.
Author
Combustion Chambers; Gas Turbines; Computerized Simulation; Gas Mixtures; Navier-Stokes Equation; Reaction Kinetics; Reynolds Averaging; Turbulent Combustion; Turbulent Flow

20000020852 Sener S.A., Madrid, Spain
TURBULENT STRUCTURE OF GENERIC LPP GAS TURBINE COMBUSTORS
Lazaro, B., Sener S.A., Spain; Gonzalez, E., Universidad Politecnica de Madrid, Spain; Alfaro, J., Universidad Carlos 3 de Madrid, Spain; Rodriguez, P., Universidad Carlos 3 de Madrid, Spain; Lecuona, A., Universidad Carlos 3 de Madrid, Spain; Gas Turbine Engine Combustion, Emissions and Alternative Fuels; June 1999, pp. 25-1 - 25-12; In English; See also 20000020829; Original contains color illustrations
Contract(s)/Grant(s): CEC-BRPR-CT95-0122; CICYT-C95013002; Copyright Waived; Avail: CASI; A03, Hardcopy; A06, Microfiche

An experimental investigation has been carried out aimed at increasing the knowledge of the turbulent flow features that characterize lean premixed prevaporized combustors for aircraft gas turbine applications. Taking into account constrains imposed by the available facilities, the design of the experimental rigs was performed to reproduce the combustor geometry and conditions being investigated under the EU sponsored LOWNOX-III program. Two different facilities were built, allowing both isothermal and reacting flow characterizations. Flow visualization, and two-component LDA and PIV systems were used as experimental techniques. Initial characterizations are presented and discussed in relation to technological relevant aspects such as combustor stability, efficiency and pollutant generation behavior.
Author
Combustion Chambers; Gas Turbine Engines; Premixing; Pollution Control; Exhaust Gases; Combustion Products; Turbulent Flow; Turbulent Combustion

20000020856 Sheffield Univ., Dept. of Chemical and Process Engineering, UK
THE USE OF FLUIDICS IN GAS TURBINE COMBUSTION DESIGN
Woolhouse, R. J., Sheffield Univ., UK; Tippetts, J. R., Sheffield Univ., UK; Whiteman, M., Sheffield Univ., UK; Young, K. J., Sheffield Univ., UK; Beck, S. B. M., Sheffield Univ., UK; Swithenbank, J., Sheffield Univ., UK; Gas Turbine Engine Combustion, Emissions and Alternative Fuels; June 1999, pp. 33-1 - 33-10; In English; See also 20000020829; Copyright Waived; Avail: CASI; A02, Hardcopy; A06, Microfiche

Current legislation demands clean combustion in gas turbines. One line of work concerning this objective at the University of Sheffield uses no-moving-part fluidic techniques to modulate flow in the combustor. Schemes described include BLC swirl vanes, a multi-inlet 'modulated swirl combustor', a switched vortex valve to provide 'fluidic VAD' and multiple ejector systems to recover mixing energy from the fuel supply. A brief description is given of a recently-started project which uses a so-called 'turn-up vortex valve' as a fuel injection device to modulate the through flow and the flowfield thereby achieving a form of variable air distribution.
Author
Air Flow; Combustion; Gas Turbine Engines; Engine Design; Vortices; Combustion Chambers

20000020865 Technische Univ., Darmstadt, Germany
OPTICAL MEASUREMENTS OF JET-MIXING IN A SWIRLING CROSSFLOW OF A COMBUSTION CHAMBER
Krautkremer, B. H., Technische Univ., Germany; Blomeyer, M. M., Technische Univ., Germany; Hennecke, D. K., Technische Univ., Germany; Gas Turbine Engine Combustion, Emissions and Alternative Fuels; June 1999, pp. 42-1 - 42-11; In English; See also 20000020829; Original contains color illustrations
Contract(s)/Grant(s): BMFT-20T9607F; Copyright Waived; Avail: CASI; A03, Hardcopy; A06, Microfiche

An experimental investigation of isothermal jet-mixing in a swirling crossflow has been conducted using a planar Miescattering technique. The mixing process has been studied in a plane model of an annular combustor segment. Aiming at a lean combustion concept, emphasis was put on both the process of homogenizing in the dilution zone and the transport of secondary air into the primary zone, driven by the recirculating flow of the airblast type atomizers which have been used as swirl generating devices without fuel addition. As consequence of the observed dependence of jet penetration on the swirling flow pattern a variation of swirler type and rotation direction under retention of the swirl number has been conducted. For a quantitative study of the mixing process also temperature measurements using the analogy between heat and mass transfer have been employed. The principal observations were: Mixing and homogenizing in the dilution zone is improved by the addition of swirl to the mainstream; Due to the three-dimensional flow field of the swirling mainstream the global momentum flux ratio has to be replaced by a local momentum flux ratio considering it as an indicator for jet penetration depth; This effect is very distinctive for the wall attached swirlers and weak for the wall detached ones; Mixing quality is better using wall attached swirlers; The tendency of all swirler configurations to pulsation causes also a time dependence of jet penetration; The pulsation caused an aerodynamic instability with effects on flow-split and mixing of the secondary air; and Orifice diameter and spacing determine the mass-split of secondary air into main and dilution zone.
Author
Optical Measurement; Jet Mixing Flow; Combustion Chambers; Combustion; Cross Flow; Swirling; Three Dimensional Flow; Temperature Measurement

20000039706 NASA Ames Research Center, Moffett Field, CA USA
MEASUREMENT REQUIREMENTS FOR IMPROVED MODELING OF ARCJET FACILITY FLOWS
Fletcher, Douglas G., NASA Ames Research Center, USA; Measurement Techniques for High Enthalpy and Plasma Flows; April 2000, pp. 3A-1 - 3A-27; In English; See also 20000039703; Copyright Waived; Avail: CASI; A03, Hardcopy

Current efforts to develop new reusable launch vehicles and to pursue low-cost robotic planetary missions have led to a renewed interest in understanding arc-jet flows. Part of this renewed interest is concerned with improving the understanding of arc-jet test results and the potential use of available computational-fluid- dynamic (CFD) codes to aid in this effort. These CFD codes have been extensively developed and tested for application to nonequilibrium, hypersonic flow modeling. It is envisioned, perhaps naively, that the application of these CFD codes to the simulation of arc-jet flows would serve two purposes: first. the codes would help to characterize the nonequilibrium nature of the arc-jet flows; and second. arc-jet experiments could potentially be used to validate the flow models. These two objectives are, to some extent, mutually exclusive. However, the purpose of the present discussion is to address what role CFD codes can play in the current arc-jet flow characterization effort, and whether or not the simulation of arc-jet facility tests can be used to eva1uate some of the modeling that is used to formu1ate these codes. This presentation is organized into several sections. In the introductory section, the development of large-scale, constricted-arc test facilities within NASA is reviewed, and the current state of flow diagnostics using conventional instrumentation is summarized. The motivation for using CFD to simulate arc-jet flows is addressed in the next section, and the basic requirements for CFD models that would be used for these simulations are briefly discussed. This section is followed by a more detailed description of experimental measurements that are needed to initiate credible simulations and to evaluate their fidelity in the different flow regions of an arc-jet facility. Observations from a recent combined computational and experimen-t.al investigation of shock-layer flows in a large-scale arc-jet facility are then used to illustrate the current state of development of diagnostic instrumentation, CFD simulations, and general knowledge in the field of arc-jet characterization. Finally, the main points are summarized and recommendations for future efforts are given.
Derived from text
Computational Fluid Dynamics; Diagnosis; Fluid Flow; Mathematical Models; Nonequilibrium Flow; Shock Layers; Simulation

20000039707 NASA Ames Research Center, Moffett Field, CA USA
NONINTRUSIVE DIAGNOSTIC STRATEGIES FOR ARCJET STREAM CHARACTERIZATION
Fletcher, Douglas G., NASA Ames Research Center, USA; Measurement Techniques for High Enthalpy and Plasma Flows; April 2000, pp. 3B-1 - 3B-37; In English; See also 20000039703; Copyright Waived; Avail: CASI; A03, Hardcopy

In the previous lecture, the issues related to arcjet flow modeling were introduced, and the limitations of conventional instrumentation in addressing these issues were discussed. The general level of understanding of the arcjet flows was seen to preclude the use of arcjets as aerothermodynamic test facilities beyond the current role in aerothermal material testing, despite their long test duration capability. In this section, the focus will be on new developments in spectroscopic instrumentation and techniques that can be brought to bear on the fundamental problem of arcjet stream characterization. Although a wide selection of arcjet facilities were introduced in the previous section, the discussion of nonintrusive diagnostic instrumentation will be restricted to the large-scale, segmented, constricted-arc heater facilities that are most widely used in thermal protection material testing for aerospace applications. After a brief review of the important features of arcjet flows, the topic of nonintrusive, optical diagnostics is introduced with a discussion of some of the basic aspects of radiative transitions. The lecture is then organized into two sections covering emission measurements and laser-induced fluorescence measurements. Emission measurements are presented next for different regions of arcjet flows, while the fluorescence measurements are presented for the free stream region only. Summaries are given for each of the two main sections, and observations on arcjet characterization by optical diagnostics in general are given at the end.
Author
Intrusion; Arc Heating; Aerothermodynamics; Characterization; Diagnosis

20000039710 Office National d'Etudes et de Recherches Aerospatiales, Departement Mesures Physiques, Chatillon, France
MOLECULAR DIAGNOSTICS FOR THE STUDY OF HYPERSONIC FLOWS
Grisch, F., Office National d'Etudes et de Recherches Aerospatiales, France; Measurement Techniques for High Enthalpy and Plasma Flows; April 2000, pp. 5-1 - 5-19; In English; See also 20000039703; Original contains color illustrations; Copyright Waived; Avail: CASI; A03, Hardcopy

New laser-based diagnostic techniques offer considerable promise for measurements in hypersonic flows. In this paper, we overview optical techniques such as Rayleigh and Raman scattering, laser-induced fluorescence, electron beam fluorescence, coherent anti-Stokes Raman scattering and diode laser absorption. These methods have unique capabilities for nonintrusive measurements of flowfield parameters such as temperature, density, species concentration and velocity. The applicability of these techniques for the study of hypersonic flows is also presented.
Author
Diagnosis; Absorption Spectroscopy; Hypersonic Flow; Laser Spectroscopy; Fluorescence

20000039711 Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Aerothermodynamics Section, Goettingen, Germany
SPECTROSCOPIC TECHNIQUES FOR MEASUREMENT OF VELOCITY AND TEMPERATURE IN THE DLR HIGH ENTHALPY SHOCK TUNNEL HEG
Beck, W. H., Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; Measurement Techniques for High Enthalpy and Plasma Flows; April 2000, pp. 7A-1 - 7A-14; In English; See also 20000039703; Copyright Waived; Avail: CASI; A03, Hardcopy

The theory of absorption techniques, including line broadening and shifts, along with a brief description of the spectroscopy of the seed species Rb, will be given. A brief overview of the diode laser itself and the experimental setup for the technique follow. Results are split into two parts: preparatory and calibration work in a test cell and a small test shock tube, followed by results in HEG, are presented. Here time profiles for gas temperature T(sub trans) and velocity u are given for various HEG run conditions.
Author
Spectroscopy; Procedures; Velocity Measurement; Temperature Measurement; Shock Tunnels

20000039712 Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Aerothermodynamics Section, Goettingen, Germany
ROTATIONAL AND VIBRATIONAL TEMPERATURE MEASUREMENTS IN THE DLR HIGH ENTHALPY SHOCK TUNNEL HEG USING LIF AND FLASH LAMP ABSORPTION
Beck, W. H., Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; Measurement Techniques for High Enthalpy and Plasma Flows; April 2000, pp. 7B-1 - 7B-26; In English; See also 20000039703; Copyright Waived; Avail: CASI; A03, Hardcopy

Use of LIF in two line thermometry TLT and of flash lamp absorption to examine high enthalpy flows is presented. The aim is to measure rotational and vibrational temperatures of nitric oxide NO in high temperature air in the Gottingen High Enthalpy Shock Tunnel HEG. Theory of NO (energy levels, spectroscopy, level populations), LIF and TLT are discussed. Results are given from a test cell to validate TLT with NO LIF as a quantitative technique. HEG results for rotational and vibrational temperatures in the free stream and around models are presented. Finally, flash lamp absorption results yielding these temperatures are given.
Author
Temperature Measurement; Rotation; Enthalpy; Shock Tunnels

20000039714 Academy of Sciences (USSR), Inst. for Problems in Mechanics, Moscow, USSR
EXTRAPOLATION FROM HIGH ENTHALPY TESTS TO FLIGHT BASED ON THE CONCEPT OF LOCAL HEAT TRANSFER SIMULATION

Kolenikov, A. F., Academy of Sciences (USSR), USSR; Measurement Techniques for High Enthalpy and Plasma Flows; April 2000, pp. 8B-1 - 8B-13; In English; See also 20000039703; Sponsored in part by RTA
Contract(s)/Grant(s): RTA-4329A; INTAS-95-1329; ISTC Proj. 036; Copyright Waived; Avail: CASI; A03, Hardcopy

The concept of the local heat transfer simulation (LHTS) of the high enthalpy flow action on a vehicle stagnation point formulated is based on the requirement to locally provide in a ground test the same boundary layer on the model at the stagnation point as at the re-entry conditions. The present methodology of the extrapolation from ground to flight consists of the three main parts: 1) the recalculation of the test conditions to flight parameters, 2) the prediction of the test conditions for the given hypersonic flight parameters and 3) the validation of the extrapolation procedure.
Author
Extrapolation; Enthalpy; Heat Transfer; Simulation; Ground Tests

20000039715 Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Wind Tunnel div., Cologne, Germany
HEAT FLUX MEASUREMENTS IN HIGH ENTHALPY FLOWS
Guelhan, A., Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; Measurement Techniques for High Enthalpy and Plasma Flows; April 2000, pp. 9A-1 - 9A-17; In English; See also 20000039703; Copyright Waived; Avail: CASI; A03, Hardcopy

This document describes the fundamentals of heat transfer measurement techniques in high enthalpy flows. After description of basic relations for the stagnation point heat flux rate to a spherical surface in a high enthalpy flow field, different heat flux measurement techniques are discussed. Attention is paid to design aspects, mathematical model for the heat flux rate evaluation and application limits of each sensor type, in order to provide a useful and practical script for the reader with respect to the choice of an adequate sensor type for different requirements. Sensor calibration and comparative measurements using different heat flux sensors in the arc heated facility LBK are described in the last two chapters.
Author
Heat Flux; Flow Measurement; Heat Measurement; Enthalpy; Heat Transfer

20010009841 National Technical Univ., Lab. of Aerodynamics, Athens, Greece
ANALYTICAL SOLUTIONS FOR THE UNSTEADY COMPRESSIBLE FLOW EQUATIONS SERVING AS TEST CASES FOR THE VERIFICATION OF NUMERICAL SCHEMES
Tsangaris, S., National Technical Univ., Greece; Pappou, Th., National Technical Univ., Greece; Verification and Validation Data for Computational Unsteady Aerodynamics; October 2000, pp. 9-27; In English; See also 20010009839; Copyright Waived; Avail: CASI; A03, Hardcopy

The verification of numerical schemes for solving the equations of inviscid and viscous compressible unsteady flow equations is limited to a small number of analytical solutions of the equations governing the one-dimensional unsteady flow including moving discontinuities. Among them the most important were given first by B. Riemann (1859-1860) and later by W.J.M. Rankine (1870). P.H. Hugoniot (1887), Lord Rayleigh (1910) and G.I. Taylor (1910). The scope of the present chapter is to overview the analytical solutions, serving as test case for the accuracy of the numerical schemes. It is worth noting that the analytical solutions are of importance for Euler and Navier-Stokes equations for laminar flow and does not give any indication for the behaviour of the numerical schemes in the prediction of turbulent flows. For each analytical solution a corresponding FORTRAN program is attached.
Author
Unsteady Flow; Mathematical Models; Flow Equations; Applications Programs (Computers)

20010067677 Office National d'Etudes et de Recherches Aerospatiales, Paris, France
HYBRID LAMINAR FIN INVESTIGATIONS
Schmitt, V., Office National d'Etudes et de Recherches Aerospatiales, France; Archambaud, J. P., Office National d'Etudes et de Recherches Aerospatiales, France; Hortstmann, K. H., Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; Active Control Technology for Enhanced Performance Operational Capabilities of Military Aircraft, Land Vehicles and Sea Vehicles; June 2001, pp. 1-1 - 1-10; In English; See also 20010067671; Original contains color illustrations; Copyright Waived; Avail: CASI; A02, Hardcopy

In order to evaluate the Hybrid Laminar Flow Control (HLFC) concept, which is seen as the most promising drag reduction technology for transport aircraft applications, Airbus Industrie launched some years ago the laminar fin program. The paper briefly describes the main phases of this program, i.e., the theoretical evaluation, the experimental verification through adequate wind tunnel tests, and the flight test demonstration with the Airbus A320 no. 1 as testbed. It will be shown that the initial phase conducted by ONERA allowed the A320 fin to be chosen as the support for further HLF investigations. The next phase was devoted to wind tunnel tests of a half-scale model in the SIMA wind tunnel. Carried out by ONERA and DLR, these tests enabled the flight test demonstration to be launched by Airbus Industrie and the partners. The flight tests have then been performed by the Airbus partners under the leadership of Daimler Chrysler Aerospace Airbus in the frame of the 3E/LATEC program. Important topics like surface and suction imperfections have also been addressed during the flight tests as part of the EC-program HYLDA. The main outcome at that stage of the analyses is an unambiguous proof of concept.
Author
Boundary Layer Control; Drag Reduction; Flight Tests; Wind Tunnel Tests; Fins

20010067678 Aircraft Research Association Ltd., Bedford, UK
TRANSITION PREDICTION AND DESIGN PHILOSOPHY FOR HYBRID LAMINAR FLOW CONTROL FOR MILITARY AIRCRAFT
Maina, M., Aircraft Research Association Ltd., UK; Wong, P. W. C., Aircraft Research Association Ltd., UK; Active Control Technology for Enhanced Performance Operational Capabilities of Military Aircraft, Land Vehicles and Sea Vehicles; June 2001, pp. 2-1 - 2-10; In English; See also 20010067671; Copyright Waived; Avail: CASI; A02, Hardcopy

An investigation into the application of transition prediction methods for hybrid laminar flow control for military aircraft has been carried out. Linear stability theory and the 'e(exp n)' criterion are commonly used for predicting the onset of transition. Although a great deal of experience has been gained in their use over the years, there are still issues involved in the use of these methods which affect the accuracy of transition prediction. The investigation has shown the importance of the inclusion of negatively oriented oblique waves in the calculation of the N-factors. The effect of these waves on the predicted N-factor values and hence transition onset has been shown to be significant and cannot be ignored. These effects are more marked for the combination of adverse pressure gradients and high angles of sweep which are relevant to military aircraft. A parametric study has been carried out to investigate the effect of surface suction or cooling on transition and to determine the appropriate suction quantities or cooling rates required to suppress the various instability modes in order to delay transition for military aircraft. Trends in the possible extents of laminar flow achievable for different pressure distributions and flow conditions with various suction and/or cooling distributions are shown and their implications for design are discussed.
Author
Boundary Layer Control; Suction; Surface Cooling; Pressure Distribution

20010067679 Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Inst. of Design Aerodynamics, Brunswick, Germany
LAMINAR DESIGN FOR SUPERSONIC CIVIL TRANSPORT
Traore, Achmed, Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; Active Control Technology for Enhanced Performance Operational Capabilities of Military Aircraft, Land Vehicles and Sea Vehicles; June 2001, pp. 3-1 - 3-7; In English; See also 20010067671; Copyright Waived; Avail: CASI; A02, Hardcopy

The paper presents a design methodology for supersonic wing sections with hybrid laminar flow control. The approach is based on coupled Euler/boundary layer flow simulation and linear stability analysis for transition prediction. The investigations show that combinations of simple pressure distribution shapes can be used to

optimize airfoils for maximum extent of laminar flow and hence minimum friction drag.
Author
Boundary Layer Control; Computerized Simulation; Laminar Flow; Stability Tests; Swept Wings

20010067680 Air Force Research Lab., Air Vehicles Directorate, Wright-Patterson AFB, OH USA
CHARACTERIZATION OF PULSED VORTEX GENERATOR JETS FOR ACTIVE FLOW CONTROL
Tilmann, Carl P., Air Force Research Lab., USA; Langan, Kevin J., Air Force Research Lab., USA; Betterton, John G., Defence Evaluation Research Agency, UK; Wilson, Mark J., Defence Evaluation Research Agency, UK; Active Control Technology for Enhanced Performance Operational Capabilities of Military Aircraft, Land Vehicles and Sea Vehicles; June 2001, pp. 5-1 - 5-13; In English; See also 20010067671; Copyright Waived; Avail: CASI; A03, Hardcopy

The flow-fields produced by several active and passive flow control devices are being investigated experimentally and numerically as part of co-operative effort between the US Air Force Research Laboratory and the UK's Defense Evaluation and Research Agency (DERA). This manuscript reports the results of an experimental investigation of pulsed vortex generator jets (PVGSs) conducted at DERA's Boundary Layer Facility in Bedford. The focus of these tests was to investigate the influence of jet velocity, pulsing frequency, and duty cycle on the mean characteristics of the flow-field produced by a PVGJ in a turbulent boundary layer. The experiments were conducted in a zero-pressure-gradient flow at a freestream velocity of 32 m/s. The flow-field was explored using a three-component laser Doppler anemometry system, and the information is used to calculate local field properties such as velocity and vorticity as well as global parameters like total circulation. The data give insight into the effectiveness of the VGs in terms of location, strength, and persistence of the generated vortices and their influence on the boundary layer. While the planned computational simulation effort is in its infancy, preliminary steady-jet computational results are compared with the flow field data that has been acquired in the boundary layer facility.
Author
Active Control; Control Equipment; Flow Distribution; Vortex Generators; Wind Tunnel Tests

20010067682 Florida Agricultural and Mechanical Univ., Dept. of Mechanical Engineering, Tallahassee, FL USA
ACTIVE CONTROL OF SUPERSONIC IMPINGING JETS
Krothapalli, A., Florida Agricultural and Mechanical Univ., USA; Elavarasan, R., Florida Agricultural and Mechanical Univ., USA; Alvi, F., Florida Agricultural and Mechanical Univ., USA; Shih, C., Florida Agricultural and Mechanical Univ., USA; Active Control Technology for Enhanced Performance Operational Capabilities of Military Aircraft, Land Vehicles and Sea Vehicles; June 2001, pp. 8-1 - 8-10; In English; See also 20010067671; Original contains color illustrations; Copyright Waived; Avail: CASI; A02, Hardcopy

Experimental studies of supersonic impinging jet flows suggest that they are greatly influenced by the flow-acoustic interactions through a feedback mechanism. The self-sustained oscillations of the jet column observed in these flows result in high velocities in the ambient medium induced by the large-scale coherent vortical structures in the jet shear layers. As a consequence, the suck down force on the surface from which the jet is issuing can reach as high as 60% of the primary jet thrust. In addition, the overall sound pressure levels (OASPL) increase significantly relative to a free jet. To alleviate these undesirable flow and acoustic characteristics, a novel control technique using supersonic microjets is demonstrated. Sixteen supersonic microjets are placed around the circumference of the main jet at the nozzle exit to disrupt the feedback mechanism. As a result, significant lift loss recovery (approximately 50%) and reduced near field OASPL (approximately 7 dB) are observed.
Author
Active Control; Supersonic Jet Flow; Jet Impingement; Feedback

20010067683 Poitiers Univ., Lab. Etudes Aerodynamiques, France
ANALYSIS OF JET INTERACTION FOR SUPERSONIC FLOW CONTROL
Collin, E., Poitiers Univ., France; Barre, S., Poitiers Univ., France; Bonnet, J. P., Poitiers Univ., France; Active Control Technology for Enhanced Performance Operational Capabilities of Military Aircraft, Land Vehicles and Sea Vehicles; June 2001, pp. 9-1 - 9-6; In English; See also 20010067671; Copyright Waived; Avail: CASI; A02, Hardcopy

In a lot of industrial applications, especially in ejectors and propulsive jets, most of the dynamical behavior of the system is strongly influenced by the mixing efficiency in a supersonic jet. This is particularly the case when dilution of hot propulsive jets is required for example to reduce infrared signature of a military aircraft. Many mechanical devices have been used to increase mixing in free shear flows. Most of these devices stimulate the activity of longitudinal vortices naturally occurring in mixing layers. For instance, the insertion of small tabs on the splitter plate of a plane mixing layer, or in the nozzle of a jet, produces large and small-scale vortical motions. This results in a strong distortion of the mean flow and a strong mixing enhancement. In order to prepare the development of an active hyper-mixing method, Davis studied a pneumatic device. A schematic arrangement of this device is shown. It is generally admitted that transverse jets generate longitudinal vorticity in a crossflow. Several control jets (CJ) can be used in order to improve the mixing in the initial part of a supersonic jet. This kind of device has been proved to be efficient in subsonic flows. The question arises of the behavior of such control jets in supersonic flows.
Derived from text
Supersonic Flow; Dynamic Characteristics; Mechanical Devices

20010067684 Air Force Research Lab., Air Vehicles Directorate, Wright-Patterson AFB, OH USA
APPLICATION OF ACTIVE CORE EXHAUST CONTROL TO ELIMINATE THE CORE THRUST REVERSER ON HEAVY LIFT AIRCRAFT
Chenault, Clarence F., Air Force Research Lab., USA; Dorris, John D., Boeing Co., USA; Active Control Technology for Enhanced Performance Operational Capabilities of Military Aircraft, Land Vehicles and Sea Vehicles; June 2001, pp. 10-1 - 10-8; In English; See also 20010067671; Copyright Waived; Avail: CASI; A02, Hardcopy

Pulsed jet blowing for mixing enhancement in a hot jet is examined using numerical simulation. Numerical simulations have been completed for a sub-scale turbojet engine, a full scale ground demonstration case, and a High-Bypass Ratio Engine (HBRE). These simulations have shown that pulsed jet blowing can significantly reduce jet plume potential core lengths at static and forward flight conditions. The numerical scheme utilizes large timestep implicit integration for efficiency, and a second order physical space algorithm for robustness. The pulsed jet disturbance is calculated directly and a turbulence model is employed to represent the cascade to smaller length scales. Experimental data corresponding to the numerical simulations are also presented and indicate similar benefits from pulsed jet mixing.
Author
Active Control; Jet Mixing Flow; Computerized Simulation; Turbulence Models

20010067688 Office National d'Etudes et de Recherches Aerospatiales, Toulouse, France
ACTIVE FLOW CONTROL ACTIVITIES AT ONERA
Gobert, J. L., Office National d'Etudes et de Recherches Aerospatiales, France; Barberis, D., Office National d'Etudes et de Recherches Aerospatiales, France; Mitchell, T., Office National d'Etudes et de Recherches Aerospatiales, France; Molton, P., Office National d'Etudes et de Recherches Aerospatiales, France; Archamband, J.-P., Office National d'Etudes et de Recherches Aerospatiales, France; Pailhas, G., Office National d'Etudes et de Recherches Aerospatiales, France; Correge, M., Office National d'Etudes et de Recherches Aerospatiales, France; Active Control Technology for Enhanced Performance Operational Capabilities of Military Aircraft, Land Vehicles and Sea Vehicles; June 2001, pp. 14-1 - 14-11; In English; See also 20010067671; Original contains color illustrations; Copyright Waived; Avail: CASI; A03, Hardcopy

In 1997, ONERA (French National Aerospace Research Establishment) created a multidisciplinary project on the subject of active flow control. Experimental work, computational fluid dynamic studies, modelling and synthesis of control laws constitute the main activities of this project. The investigations include laminarity control, buffet control in transonic conditions, and control of separated flows

and vortices. This document presents the results obtained during some of these activities.
Author
Active Control; Computational Fluid Dynamics; Flow Characteristics; Wind Tunnel Tests

20010067690 Deutsches Zentrum fuer Luft- und Raumfahrt e.V., Inst. fuer Stroemungsmechanik, Goettingen, Germany
SHOCK CONTROL BY ADAPTIVE ELEMENTS FOR TRANSPORTATION AIRCRAFT WINGS
Rosemann, H., Deutsches Zentrum fuer Luft- und Raumfahrt e.V., Germany; Birkemeyer, J., Deutsches Zentrum fuer Luft- und Raumfahrt e.V., Germany; Knauer, A., Deutsches Zentrum fuer Luft- und Raumfahrt e.V., Germany; Active Control Technology for Enhanced Performance Operational Capabilities of Military Aircraft, Land Vehicles and Sea Vehicles; June 2001, pp. 16-1 - 16-6; In English; See also 20010067671; Original contains color illustrations; Copyright Waived; Avail: CASI; A02, Hardcopy

Different devices for the application of shock and boundary layer control on transportation aircraft wings have been investigated on 2-D airfoils and on a swept wing model. A cavity in the surface underneath the foot of the shock covered with a perforated plate reduces shock strength and hence wave drag, but viscous drag increases such that a net drag reduction can not be achieved in most cases. The application of additional boundary layer suction reduces the additional viscous drag, but not enough to result in a significant gain in total drag. On the contrary a contour bump underneath the shock, applied alone or in combination with suction, reduces very effectively wave drag without increasing viscous drag so that under off-design conditions up to 24% total drag reduction has been measured for a 2-D airfoil and somewhat lower values for the swept wing. This effect has been well predicted by numerical methods. Both devices especially the perforation, have a positive influence on the buffet boundary. Trailing edge devices such as conventional and Gumey-type ad flaps also effect wave drag by redistributing the pressure on the wing or airfoil. Combining them with a contour bump has been investigated numerically. The results show that by careful optimization of the flap deflection together with the corresponding bump location and height a better performance can be achieved compared to the application of either device alone.
Author
Airfoils; Boundary Layer Control; Drag Reduction; Swept Wings; Control Equipment

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INSTRUMENTATION AND PHOTOGRAPHY

19990040720 Naval Air Warfare Center, Photogrammetry Branch, Patuxent River, MD USA
NAWCAD PHOTOGRAMMETRICS: METHODS AND APPLICATIONS FOR AVIATION TEST AND EVALUATION
Williams, James W., Naval Air Warfare Center, USA; Stancil, Robert F., Naval Air Warfare Center, USA; Forsman, Alec E., Naval Air Warfare Center, USA; Aircraft Weapon System Compatibility and Integration; April 1999, pp. 8-1 - 8-6; In English; See also 19990040714; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

Photogrammetry using multiple sequential recorded film and video images has been an integral part of flight test and evaluation at the Naval Air Warfare Center Aircraft Division (NAWCAD) at Patuxent River, MD for nearly 40 years. Photogrammetric analysis is used for evaluation of stores separation, carrier suitability, ballistic trajectory tracking, overhead impact scoring, and mishap reconstruction. NAWCAD, Patuxent River, MD recently began flight testing for the F/A-18 E/F development program. The initial phase of the weapons separation portion of the F/A-18E/F development program is a 13 month project consisting of two aircraft flying 256 flights during which 2000 stores will be dropped. To meet the challenge of processing high volumes of photogrammetric data and delivering solution within 72 hours of each flight, the NAWCAD Photogrammetric Team initiated strategies to reduce the time, increase the volume of data analysis, and increase the accuracies of solution processes that historically have been labor intensive and difficult to present. The NAWCAD Photogrammetric Team is developing an image enhancement and data analysis system, and an on-line database which will provide near real-time access and retrievability of test data. This paper describes how NAWCAD scientists have applied a clearly defined process for photogrammetric efforts, implemented state-of-the-art hardware and software methodologies, and architecture that reduce the turnaround time, reduce the cost, increase the accuracy, and facilitate the delivery of custom formatted products to the flight test engineer.
Author
Photogrammetry; Systems Compatibility; External Store Separation; Ballistic Trajectories; Flight Tests; Data Processing

19990056413 Research and Technology Organization, Systems Concepts and Integration Panel, Neuilly-sur-Seine, France
OPTICAL GYROS AND THEIR APPLICATION *[GYROSCOPES OPTIQUES ET LEURS APPLICATIONS]*
May 1999; 314p; In English; See also 19990056414 through 19990056427; Original contains color illustrations
Report No.(s): RTO-AG-339; AC/323(SCI)TP/9; ISBN 92-837-1014-2; Copyright Waived; Avail: CASI; A14, Hardcopy; A03, Microfiche

This AGARDograph is written by leading experts from France, Germany, Russia and the USA. It consists of 15 chapters that can be divided into four main parts. The first one gives a detailed description of the laser and fiber optical gyro theory, the main sources of errors and the methods used to reduce their influence. The analysis of many types of modern laser gyros allowing various requirements to accuracy, dimension, weight and cost is presented in the second part. The reader can also find here some areas of practical applications of laser gyros. The third part is devoted to fiber optical gyros that have been developed recently and which are very successful technologically and commercially. The last part of the book considers special applications of optical gyros for laser dynamic goniometry and metrology, fundamental and applied research (such as nuclear physics, aerodynamics, etc.), railway track surveying and estimation of deformation of objects.
Author
Laser Gyroscopes; Optical Gyroscopes; Fiber Optics; Sagnac Effect; Integrated Optics

19990056414 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Inst. of Flight Guidance, Brunswick, Germany
PHYSICAL BACKGROUND AND TECHNICAL REALIZATION
Rodloff, R., Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Germany; Optical Gyros and Their Application; May 1999, pp. 2-1 - 2-16; In English; See also 19990056413; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

This paper analyzes many aspects of the Sagnac Effect. It gives an introduction, discusses historical review, sagnac effect as a simplified model, sagnac effect as a relativistic effect, and the practical aspects on how to use the sagnoc effect.
CASI
Sagnac Effect; Laser Gyroscopes; Optical Gyroscopes

19990056415 Aronowitz (Frederick), Dewey, AZ USA
FUNDAMENTALS OF THE RING LASER GYRO
Aronowitz, Frederick, Aronowitz (Frederick), USA; Optical Gyros and Their Application; May 1999, pp. 3-1 - 3-45; In English; See also 19990056413; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

In this review, a simple description of the operation of the ring laser gyro (RLG) will be presented. The theoretical model, as it is known, will be presented, with a discussion on the distinction between what is known about the model and how it is typically used. Scale factor of the RLG and units will be covered. Typical errors will be discussed, with emphasis on coupling and the lock-in mechanism. The mechanical dither technique to avoid the lock-in problem will be discussed in detail. Other techniques used to avoid lock-in will be discussed, but with less detail. The fundamental limit of operation will be covered. A comparison of the various approaches to fabrication of the RLG will be made.
Derived from text
Ring Lasers; Laser Gyroscopes; Laser Interferometry; Sagnac Effect; Design Analysis

19990056416 Litton Guidance and Control Systems, Woodland Hills, CA USA
MULTIOSCILLATOR RING LASER GYROSCOPES AND THEIR APPLICATIONS
Volk, C. H., Litton Guidance and Control Systems, USA; Gillespie, S. C., Litton Guidance and Control Systems, USA; Mark, J. G., Litton Guidance and Control Systems, USA; Tazartes, D. A., Litton Guidance and Control Systems, USA; Optical Gyros and Their Application; May 1999, pp. 4-1 - 4-26; In English; See also 19990056413; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

The ring laser gyroscope has been both a technological and commercial success, having displaced the mechanical gyroscope as the angular sensor of choice for a variety of applications including navigation and motion control, The ring laser gyroscope provides excellent performance at lower cost and with higher reliability than is achievable with the mechanical gyroscopes, which are inherently more complicated and prone to wear-out.
Derived from text
Ring Lasers; Laser Gyroscopes; Optical Gyroscopes; Sagnac Effect; Oscillators

19990056417 Academy of Sciences (USSR), Research and Development Inst., Moscow, USSR
ZEEMAN LASER GYROSCOPES
Azarova, V. V., Academy of Sciences (USSR), USSR; Golyaev, Y. D., Academy of Sciences (USSR), USSR; Dmitriev, V. G., Academy of Sciences (USSR), USSR; Drozdov, M. S., Academy of Sciences (USSR), USSR; Kazakov, A. A., Academy of Sciences (USSR), USSR; Melnikov, A. V., Academy of Sciences (USSR), USSR; Nazarenko, M. M., Academy of Sciences (USSR), USSR; Svirin, V. N., Academy of Sciences (USSR), USSR; Soloviova, T. I., Academy of Sciences (USSR), USSR; Tikhmenev, N. V., Academy of Sciences (USSR), USSR; Optical Gyros and Their Application; May 1999, pp. 5-1 - 5-29; In English; See also 19990056413; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

The purpose of this paper is to discuss the many different aspects of Zeeman Laser Gyroscopes. Included in this paper is an introduction, and discussions on: Zeeman effect and basic principles of the laser gyros on this effect; Out-of-plane cavity - Polarization characteristics - Cavity modes; Energy coupling and lock-in effect for counter-propagating waves in the ring laser with the out-of-plane cavity; Error model of Zeeman laser gyro design; Zeeman laser gyro behavior under severe environment; and Application of Zeeman laser gyro.
CASI
Laser Gyroscopes; Ring Lasers; Zeeman Effect

19990056418 Bauman Moscow State Technical Univ., Moscow, Russia
LASER GYROS WITH TOTAL REFLECTION PRISMS
Bakin, Y. V., Bauman Moscow State Technical Univ., Russia; Ziouzev, G. N., Bauman Moscow State Technical Univ., Russia; Lioudomirski, M. B., Bauman Moscow State Technical Univ., Russia; Optical Gyros and Their Application; May 1999, pp. 6-1 - 6-29; In English; See also 19990056413; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

This paper discusses laser gyros with total reflection prisms. It was obvious from the first steps of laser gyroscopy development, that a ring cavity with high Q-factor and low back-scattering level is a basis of precise laser gyro (LG). To provide minimal losses inside the cavity reflective elements with maximal reflectivity are to be used. Essentially greatest reflectivity (equal to unit) can be provided if the total internal reflection effect is used. Because of this matter the ring cavities techniques development initially went in two directions - investigations of mirror cavities and cavities with total reflection prisms (TRP).
CASI
Laser Gyroscopes; Ring Lasers; Prisms; Cavities; Mirrors

19990056419 Photonetics S.A., Marly-le-Roi, France
APPLICATION OF THE SAGNAC EFFECT IN THE INTERFEROMETRIC FIBER-OPTIC GYROSCOPE
Lefevre, Herve C., Photonetics S.A., France; Optical Gyros and Their Application; May 1999, pp. 7-1 - 7-29; In English; See also 19990056413; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

This chapter reviews the basics of the interferometric fiber-optic gyroscope (I-FOG) fundamental principle based on Sagnac effect, importance of reciprocity and single-mode propagation, analysis of coherence and polarization problems, signal processing techniques. It also describes the technological progresses of guided-wave components (single-mode optical fiber, semi-conductor diode source, integrated optics, in-line fiber components). Finally, recent trends like multi-axis configurations and rare-earth doped fiber source are presented.
Author
Fiber Optics; Laser Gyroscopes; Optical Gyroscopes; Sagnac Effect; Laser Interferometry

19990056420 Deutsche Aerospace A.G., Munich, Germany
PASSIVE ALL-FIBER A OPEN LOOP GYROSCOPE
Trommer, G., Deutsche Aerospace A.G., Germany; Optical Gyros and Their Application; May 1999, pp. 8-1 - 8-15; In English; See also 19990056413; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

For years research and development in the fiber optic gyro area have concentrated on better performances, touching the physical limits of the respective concepts. Fiber optic gyroscopes (FOG) with sophisticated signal recovery schemes were generated and started to compete with well-established mechanical gyros or laser gyros. The other part of the gyro market concerning lower performance, but essentially lower priced gyros for stabilization or short time navigation, has received less attention. To realize low prices, the standard solution of the so-called minimum configuration with nonreciprocal phase modulation seems to be inadequate, requiring too complex photonics and fast electronics circuits. Here a different approach is presented, basing on a passive all-fiber open loop gyroscope. This new FOG concept is mainly directed to the low cost and low-to-medium performance sector.
Derived from text
Laser Gyroscopes; Optical Gyroscopes; Fiber Optics

19990056421 Fizoptika Co. Ltd., Moscow, Russia
MINIATURE FIBER OPTIC GYRO: FIZOPTIKA IMPLEMENTATION
Listvin, V., Fizoptika Co. Ltd., Russia; Logozinski, V., Fizoptika Co. Ltd., Russia; Solomatin, V., Fizoptika Co. Ltd., Russia; Optical Gyros and Their Application; May 1999, pp. 9-1 - 9-6; In English; See also 19990056413; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

The results of development of the fiber optic rotation sensors (FOG) for industrial applications performed during last several years in FIZOPTIKA Co. are reflected in the report. The major primary FOG components and main steps of the in-line spliceless technology for FOG manufacturing are described. The parameters, main features, and applications of standard FOG models are presented. Specific FOG errors are analyzed and potentials to improve its performance are discussed.
Author
Fiber Optics; Laser Gyroscopes; Optical Gyroscopes; Sagnac Effect

19990056422 SFIM Industries Deutschland G.m.b.H., Murr, Germany
PROGRESS IN FIBER-OPTIC GYRO DEVELOPMENT AND APPLICATIONS
Auch, Wilfried, SFIM Industries Deutschland G.m.b.H., Germany; Optical Gyros and Their Application; May 1999, pp. 10-1 - 10--10; In English; See also 19990056413; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

The SFIM Industries single-axis fiber-optic gyros and inertial measurement units are described. Application areas are identified and rationale is given for the use of the fiber-optic gyro in different market segments. The applications reach from retrofit of mechanical rate gyros to integrated hybrid navigation systems. The ongoing development and engineering effort is now concentrating on miniaturized multiple-axes solutions. The most promising subsystem is a tactical grade inertial measurement unit with a fiber-optic gyro triad as rotation rate sensors.
Author
Fiber Optics; Laser Gyroscopes; Optical Gyroscopes

19990056423 Honeywell Technology Center, Phoenix, AZ USA
PROGRESS IN FIBER-OPTIC GYROSCOPE APPLICATIONS II WITH EMPHASIS ON THE THEORY OF DEPOLARIZED GYROS
Sanders, G. A., Honeywell Technology Center, USA; Szafraniec, B., Honeywell Technology Center, USA; Optical Gyros and Their Application; May 1999, pp. 11-1 - 11-42; In English; See also 19990056413; Original contains color illustrations; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

Fiber-optic gyroscopes (FOGs) are under development as the next generation inertial sensor and are showing considerable potential toward meeting even the most stringent of applications. We report promising results of efforts aimed at inertial-navigation quality (0.01 deg/hr) using a low cost depolarized FOG design. This design using a single-mode (SM) fiber sensing coil presents unique challenges which are the focus of a detailed analysis. Both a Jones matrix formulation and a Poincare sphere description are used. We also present the progress of efforts on precision (0.001 deg/hr) FOG designs as well as update the status of a medium grade open-loop product for attitude heading reference system (AHRS) applications. Author

Fiber Optics; Laser Gyroscopes; Sagnac Effect; Optical Gyroscopes

19990056424 Saint Petersburg State Electrotechnical Univ., Autonomous Navigation Dept., Saint Petersburg, Russia
DYNAMIC RING LASER GONIOMETER
Filatov, Y. V., Saint Petersburg State Electrotechnical Univ., Russia; Loukianov, D. P., Saint Petersburg State Electrotechnical Univ., Russia; Pavlov, P. A., Saint Petersburg State Electrotechnical Univ., Russia; Burnashev, M. N., Saint Petersburg State Electrotechnical Univ., Russia; Probst, R., Physikalisch-Technische Bundesanstalt, Germany; Optical Gyros and Their Application; May 1999, pp. 12-1 - 12-30; In English; See also 19990056413; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

The purpose of this paper is to discuss the principle of the ring laser (RL) goniometer, the accuracy of the dynamic laser goniometer (DLG), the main modes of DLG operation and key elements, and the perspective of development and application of the DLG. This is accomplished by discussions of the following: a short history of (DLG), principle of measurement, comparison of dynamic and static methods of measurements, model of DLG's errors, the DLG model accounting the real output response of the RL, the consideration of the DLG base angle vibrations, the quantization errors, the potential limit of the DLG accuracy, the optical polygon calibration, the optical encoders calibration, the external noncontact angle measurements, the DLG in X-ray two crystal diffractional spectrometer of St. Petersburg Nuclear Physics Institute, the inertial angle measurements by means of the DLG, the DLG in technology of circular scales production, and the necessity and perspectives of creation of plane angle standard in dynamics on the base of the DLG.
CASI

Goniometers; Laser Gyroscopes; Ring Lasers

19990056425 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Inst. of Flight Guidance, Brunswick, Germany
GYROSCOPIC GONIOMETRY DURING QUASISTATIC AND KINEMATIC CONDITIONS USING A NEW AND CONVENTIONAL METHODS FOR AIDING
Stieler, B., Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Germany; Optical Gyros and Their Application; May 1999, pp. 13-1 - 13-25; In English; See also 19990056413; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

Gyroscopic goniometry necessitates the calibration of scalefactor error and drift. Conventional on-line and off-line methods are discussed based upon external angle and angular rate information - zero velocity update (ZUPT) in the latter case. A new method is also presented - the Differential Inertial Measurement Technique (DIMT) - which allows to calibrate time-dependent measurement errors during recurring but identical measurement conditions of the inertial sensor or system. No absolute external references are required, since DIMT handles measurement differences at different points in time. DIMT can be regarded as an extension to ZUPT, but without the constraint of the sensor or system being at rest. It opens a great variety of applications. All methods are verified with the quasistatic measurements of the angles of a quadrangle, the measurements of angles during recurring motions like in a robot or during tests of railway tracks and during measurements of angular characteristics like those of a wind tunnel model, i.e. the dependence of lift upon the angle of incidence. A fiberoptic gyro is used as sensor.
Author

Fiber Optics; Goniometers; Laser Gyroscopes; Optical Gyroscopes

19990056426 Saint Petersburg State Electrotechnical Univ., Saint Petersburg, Russia
APPLICATION OF A LASER GYRO IN TRACK MEASURING SYSTEMS
Loukianov, D. P., Saint Petersburg State Electrotechnical Univ., Russia; Mochalov, A. V., Saint Petersburg State Electrotechnical Univ., Russia; Rechel, M., DB Zentralbereich Basistechnologien, Germany; Optical Gyros and Their Application; May 1999, pp. 14-1 - 14-14; In English; See also 19990056413; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

This paper is a discussion on the development of track measuring systems and the basic challenges, the design principles of track measuring systems on laser gyros, medium and high accuracy systems, integrated navigational systems, and the prospects for the track measurement system development.
CASI

Laser Gyroscopes; Optical Gyroscopes; Design Analysis; Systems Engineering

19990056427 Saint Petersburg State Electrotechnical Univ., Saint Petersburg, Russia
A SYSTEM FOR MEASURING DEFORMATIONS OF LARGE-SIZED OBJECTS
Mochalov, A. V., Saint Petersburg State Electrotechnical Univ., Russia; Optical Gyros and Their Application; May 1999, pp. 15-1 - 15-9; In English; See also 19990056413; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

The discussions in this paper are as follows: a method for measuring static and dynamic deformations, observability and errors of the system, and a practical implementation of the method.
CASI

Laser Gyroscopes; Inertial Navigation; Navigation Instruments; Flight Control

20000012173 Saint Petersburg State Electrotechnical Univ., Saint Petersburg, Russia
LASER AND FIBER-OPTICAL GYROS: THE STATUS AND TENDENCIES OF DEVELOPMENT
Loukianov, D. P., Saint Petersburg State Electrotechnical Univ., Russia; 6th Saint Petersburg International Conference on Integrated Navigation Systems; October 1999, pp. 1-1 - 1-18; In English; See also 20000012172; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

The analysis of the status and tendencies of development of laser (RLG) and fiber-optic gyros (FOG) is based on the study of the research, development and production of the leading companies in Russia, the USA, France and Germany. RLGs of different architectures are considered: those with planar and nonplanar resonators, mirrors and totally reflecting prisms, employing various methods for linearizing the output characteristic. The development of ring lasers with superlarge perimeter from 4 to 14 m for fundamental research is discussed. Notable achievements in the field of optical waveguides and integrated optics provided revolutionary progress in the development of FOGs which are conquering the domestic and international markets. The present-day architecture of FOGs, their main components and error models are considered. Particular attention is given to a promising line in the development of FOGs that uses the effect of controlled pseudorandom polarization and depolarization of counter-propagating waves which allowed the FOG's drift to be reduced to the level of 0.005 deg. per hour and better.
Author

Fiber Optics; Laser Gyroscopes; Mathematical Models; Optical Waveguides

20000012176 Bauman Moscow State Technical Univ., Moscow, Russia
PECULIARITIES OF CALIBRATING THE TRIAD OF ACCELEROMETERS
Konovalov, S. F., Bauman Moscow State Technical Univ., Russia; Yurasov, V. V., Bauman Moscow State Technical Univ., Russia; 6th Saint Petersburg International Conference on Integrated Navigation Systems; October 1999, pp. 4-1 - 4-7; In English; See also

20000012172; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

In inclinometery process of oil and gas wells (inclined and horizontal) three accelerometers with orthogonal sensitive axes are used as inclinometer sensors. The process of lowering devices in a borehole is accompanied by fast temperature change which for tens of minutes can be approx. 100 ... 120 C. If accelerometers have different scale factor (SF) temperature coefficients, intolerable large error in determination of zenith angle can arise. The attempts of using algorithmic compensation are inefficient in this case as it is required to carry out this procedure in unsteady temperature mode. Moreover, algorithmic compensation is not capable to eliminate errors connected with irreversible changes of magnetization of accelerometer torquer magnets due to thermal and possible mechanical shocks which accompanies lowering the devices in borehole. The problem is solved by creation of the triad of accelerometers in which strictly coordinated SF change of all devices being incorporated into the triad is provided. The specified triad of accelerometers is of interest not only for inclinometry, of wells, but also for inertial navigation as the use of the triad significantly simplifies and accelerates a process of preflight calibration.
Author
Accelerometers; Calibrating; Inclination; Inertial Navigation; Design Analysis; Mathematical Models; Algorithms

20000012177 Council of Scientific and Industrial Research, Materials and Manufacturing Dept., Pretoria, South Africa
INFLUENCE OF PRESTRESS ON DYNAMICS FO HEMISPHERICAL RESONATOR GYROSCOPE
Shatalov, M. Y., Council of Scientific and Industrial Research, South Africa; Lunin, B. S., Moscow State Univ., Russia; 6th Saint Petersburg International Conference on Integrated Navigation Systems; October 1999, pp. 5-1 - 5-10; In English; See also 20000012172; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

Inner prestresses result from the mechanical treatment of a resonator or from inertial motion of the gyroscope, for example, its rotation. Their analysis is complex from the theoretical viewpoint because it is necessary to consider the nonlinear geometry of the shell. It is also difficult from the view point of numerical analysis by means of finite element methods due to infinity of different possibilities for inner prestress distributions. This problem of influence of the prestresses on dynamics of a hemispherical resonator gyroscope is investigated analytically. On the basis of analysis of nonlinear geometry of a hemisphere the terms responsible for the prestresses are introduced in the expression for the strain energy of the resonator and the problem is solved in linear approximation. The example of an important case of a particular distribution of local stresses is considered. The special case of influence of centrifugal forces on the dynamics of a rotating gyroscope is investigated.
Author
Gyroscopes; Resonators; Prestressing; Finite Element Method; Mathematical Models; Rotation; Hemispherical Shells

20000012178 Moscow Inst. of Electromechanics and Automatics, Moscow, Russia
HEMISPHERICAL RESONATOR GYRO TECHNOLOGY: PROBLEMS AND POSSIBLE WAYS OF THEIR SOLUTIONS
Izmailov, E. A., Moscow Inst. of Electromechanics and Automatics, Russia; Kolesnik, M. M., Moscow Inst. of Electromechanics and Automatics, Russia; Osipov, A. M., Moscow Inst. of Electromechanics and Automatics, Russia; Akimov, A. V., Moscow Inst. of Electromechanics and Automatics, Russia; 6th Saint Petersburg International Conference on Integrated Navigation Systems; October 1999, pp. 6-1 - 6-9; In English; See also 20000012172; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

Hemispherical Resonator Gyro (HRG) technology is now considered as one of the promising gyroscope technologies. However, to implement HRG potential capabilities one should solve a number of problems connected both with manufacturing an isotropic resonator having a high mechanical Q-factor and with conserving its parameters within the gyro. The article, basing on the experience of developing HRGs of two standard sizes, presents some of the mentioned problems and the results of mock-up tests.
Author
Gyroscopes; Resonators; Mathematical Models; Q Factors; Hemispherical Shells

20000012179 Ukrainian Center for Optical Instrument Technology, Kiev, Ukraine
TECHNOLOGICAL ASPECTS OF MANUFACTURING OF COMPOUND HEMISPHERICAL RESONATORS FOR SMALL-SIZED VIBRATORY GYROSCOPES
Yatsenko, Y. A., Ukrainian Center for Optical Instrument Technology, Ukraine; Petrenko, S. F., Ukrainian Center for Optical Instrument Technology, Ukraine; Vovk, V. V., Ukrainian Center for Optical Instrument Technology, Ukraine; Chikovani, V. V., Ukrainian Center for Optical Instrument Technology, Ukraine; 6th Saint Petersburg International Conference on Integrated Navigation Systems; October 1999, pp. 7-1 - 7-6; In English; See also 20000012172; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

Technological processes for manufacturing of low-cost compound hemispherical resonators are presented in this paper. The compound resonator consists of hemispherical shell (meniscus) and stem, which are made separately with use of the well fulfilled technology of spherical and cylindrical optics. Manufacturing technology of compound resonator elements is described in the paper. Geometrical and dynamic characteristics of meniscus are given. This work was conducted within the frame of the STCU (The International Science and Technology Centre in Ukraine) joint project with Lileya Ltd., 'Arsenal' Corp. and Litton Guidance and Control Systems as collaborators.
Author
Vibration; Gyroscopes; Manufacturing; Hemispherical Shells; Resonators; Dynamic Characteristics

20000039716 Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Wind Tunnel Div., Cologne, Germany
APPLICATION OF PYROMETRY AND IR-THERMOGRAPHY TO HIGH SURFACE TEMPERATURE MEASUREMENTS
Guelhan, A., Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; Measurement Techniques for High Enthalpy and Plasma Flows; April 2000, pp. 9B-1 - 9B-24; In English; See also 20000039703; Copyright Waived; Avail: CASI; A03, Hardcopy

In this document the non-intrusive temperature measurement techniques like pyrometry and IR-thermography and their application at high temperatures are described. For a better understanding first some basic relations of thermal radiation are discussed followed by the absorption behaviour of the atmosphere and optical glasses. Main properties of different IR detector types follows this chapter. Chapters five and six are devoted to the description of pyrometers and IR-cameras including a comparison of different detectors, data reduction and im- aging techniques. Based on the experience from application of IR devices at the arc heated facility LBK, some requirements on an IR-system for its use at high enthalpy facilities are defined. Results of comparative and complementary measurements of the surface temperature of several thermal protection materials using pyrometers and IR-cameras are presented in chapter nine.
Author
Pyrometers; Thermography; Temperature Measurement; Thermal Radiation; Infrared Instruments

20010012833 Sira Inst. Ltd., Chislehurst, UK
COMPACT HIGH RESOLUTION IMAGING SPECTROMETER (CHRIS)
Cutter, Mike A., Sira Inst. Ltd., UK; Space-Based Observation Technology; October 2000, pp. 24-1 - 24-4; In English; See also 20010012824; Original contains color illustration; Copyright Waived; Avail: CASI; A01, Hardcopy

This paper describes a hyperspectral imaging system known as CHRIS (Compact High Resolution Imaging Spectrometer) which has been designed for operation on a spaceborne platform. CHRIS is designed to take images of the Earth in multiple spectral bands over the spectral region 415 to 1050 nm. Band selection is programmable. The instrument is planned to be launched, in 2001, on an agile small satellite of the 100 kg class. This satellite will operate in a sun-synchronous, high inclination orbit with an altitude in the range 700 to 830 km. The instrument can provide 19 spectral bands with a spatial sampling interval of 25 m at nadir and 37 bands at 50 m, at an altitude of 830 km. The field of view of CHRIS is 19 km from 830 km altitude. Attitude control of the platform will allow access to non-nadir

targets, multi-angle observations of selected targets and improved radiometric resolution.
Derived from text
Imaging Spectrometers; Imaging Techniques; Remote Sensing

20010012835 Officine Galileo S.p.A., Florence, Italy
DEVELOPMENT OF CRITICAL TECHNOLOGIES FOR THE COSMO/SKYMED HYPERSPECTRAL CAMERA
Labate, D., Officine Galileo S.p.A., Italy; Svelto, F., Italian Space Agency, Italy; Space-Based Observation Technology; October 2000, pp. 27-1 - 27-9; In English; See also 20010012824; Copyright Waived; Avail: CASI; A02, Hardcopy

COSMO/SkyMed is a spaceborne program primarily dedicated to Earth observation, remote sensing and data exploitation for risks management, defence and intelligence applications and coastal zone monitoring. This program is going on under a contract of Agenzia Spaziale Italiana (ASI) that foresees also the development of critical technologies. In the frame of this program, Officine Galileo is involved in some technological studies devoted to finalize the design of a hyperspectral camera (HYC) that will be part of the mission payload. An instrument with state-of-art performance but with reduced mass, volume and power budgets is the challenging aim of these studies. The major tasks performed are: manufacturing of very light mirrors with special emphasis on Silicon Carbide (SiC) material technology. development of electronics blocks at high integration level with the necessary speed for the acquisition and processing of the large amount of hyperspectral data testing of high quantum efficiency array detectors The developed or under test subsystems are all parts of the HYC. This paper presents just an overview of the camera design and it will focus on these subsystems development studies.
Derived from text
Earth Observations (From Space); Data Acquisition; Earth Observing System (Eos); Remote Sensing; Cameras

20010012836 Alcatel Space Industries, Cannes la Bocca, France
CHARACTERIZATION OF INFRARED DETECTORS FOR SPACE APPLICATIONS
Dantes, Didier, Alcatel Space Industries, France; Space-Based Observation Technology; October 2000, pp. 28-1 - 28-7; In English; See also 20010012824; Copyright Waived; Avail: CASI; A02, Hardcopy

Over the past decade, Alcatel Space Industries has become Europe's leader in the field of optical payloads for space applications : earth observation in the infrared spectral range, early warning systems, optical payloads for meteorology and sciences. This position was made possible by Alcatel Space Industries' will to develop the assets required for mastering the key performances of optical payloads, i.e. geometrical, modulation transfer function, radiometric and spectral performances. Infrared detectors have a heavy weigh in the performances of infrared payloads, and this leaded Alcatel Space Industries to perform very accurate characterization of infrared detectors. This paper looks at those figures of merit of infrared detectors which are of interest to optical payload's performances. These parameters are detector sensitivity and associated dispersions, temporal noise and associated dispersions, contributors to spatial noise (pixel to pixel variation of non linearity, spectral response, 1/f noise, dark level variation versus temperature... frequency response, modulation transfer function, geometrical detector performances. The techniques required for detector characterizations compliant with the required accuracies for each of these parameters are described. Performances of test benches available at Alcatel Space Industries are presented, with associated performances: vacuum chambers and cooling test sets, optical sources for radiometric and MTF measurements, electronics for detector power supply, clock generation, video and image processing.
Author
Infrared Detectors; Payloads; Technology Utilization; Earth Observations (From Space); Early Warning Systems; Infrared Radiation

20010058974 Queens Univ., Dept. of Mechanical Engineering, Kingston, Ontario Canada
ACCURACY OF THE ISCAN PRESSURE MEASUREMENT SYSTEM
Wilson, David R., Queens Univ., Canada; Eichler, Mark J., Beth Israel Deaconess Medical Center, USA; Hayes, Wilson C., Beth Israel Deaconess Medical Center, USA; Soldier Mobility: Innovations in Load Carriage System Design and Evaluation; May 2001, pp. 23-1 - 23-4; In English; See also 20010058955; Copyright Waived; Avail: CASI; A01, Hardcopy

The Iscan system can be used to measure continuously changing force and pressure distribution at biomechanical interfaces. The objective of this study was to determine how accurately the Iscan system measures force and force distribution in static loading. Known absolute and relative loads were applied to Iscan sensors using custom-built indentors loaded in a servohydraulic test machine. Over the 35 trials, the mean error for the absolute measurement of force was 6.5% and the standard deviation of the error was 4.4%. The mean error in the force distribution measurement over the 25 trials was 0.86% and the standard deviation of the error was 0.58%. The results suggest that, when calibration, conditioning and testing protocols are developed carefully, the Iscan system measures force and pressure distribution more accurately than Fuji Prescale film.
Author
Force Distribution; Pressure Distribution; Pressure Measurement; Weight (Mass); Accuracy

20010067716 California Univ., Mechanical and Aerospace Engineering Dept., Los Angeles, CA USA
DESIGN AND TESTING OF A MESOSCALE ACTUATOR DEVICE
Park, Joon, California Univ., USA; Keller, Scott, California Univ., USA; Carman, Gregory P., California Univ., USA; Hahn, H. Thomas, California Univ., USA; Active Control Technology for Enhanced Performance Operational Capabilities of Military Aircraft, Land Vehicles and Sea Vehicles; June 2001, pp. 18-1 - 18-6; In English; See also 20010067671
Contract(s)/Grant(s): DAAH04-95-1-0095; Copyright Waived; Avail: CASI; A02, Hardcopy

The design and testing of a mesoscale actuator device is presented in this paper. The device uses frequency rectification concepts to amplify the displacements while retaining comparable force outputs to current piezoelectric actuators. The design is based on an inchworm motor with the exception that microridges are used in the clamping system. A FEM model is used to design a device that produces a peak to peak amplitude of 900 N at 11 mm/sec with a weight of 100 g (i.e., specific power of 99 W/kg). A prototype device is fabricated and tested with excellent agreement between analysis and testing results. Stress and modal analysis are used to demonstrate that the device has an infinite fatigue life and a first modal frequency at 1777 Hz.
Author
Actuators; Stress Analysis; Prototypes; Piezoelectricity

36
LASERS AND MASERS

20000037814 Italian Air Force, Comando Lofistico, Rome, Italy
LASER DESIGNATION POD ON THE ITALIAN AIR FORCE AM-X AIRCRAFT: A PROTOTYPE INTEGRATION
Donzelli, Paolo, Italian Air Force, Italy; Marozza, Roberto, Italian Air Force, Italy; Advances in Vehicle Systems Concepts and Integration; April 2000, pp. A16-1 - A16-10; In English; See also 20000037804; Copyright Waived; Avail: CASI; A02, Hardcopy

The paper describes the prototype integration, on the Italian Air Force AM-X aircraft, of the Thomson Convertible Laser Designation Pod. The integration was conducted within the Italian Air Force Official Test Centre, and the process adopted was devised to produce a quick, low-cost, and low-risk sub-system integration. Software had the greatest part in the project, and software-engineering methods have been used to support the effort. This integration is a good example of how a careful use of existing assets and experiences, together with the application of advanced software engineering techniques, can improve the effectiveness of an aircraft, keeping it up with the evolving needs. The integration is now being used as baseline by the aircraft manufacturer, thus reducing costs and times for the Italian Air Force.
Author
Software Engineering; Systems Integration; Pods (External Stores); Lasers

20000039709 Rouen Univ., Centre National de la Recherche Scientifique, France
LASER INDUCED FLUORESCENCE IN HIGH ENTHALPY FACILITIES IN THE TSNIIMACH CENTER (MOSCOW - RUSSIA)
Robin, L., Rouen Univ., France; Measurement Techniques for High Enthalpy and Plasma Flows; April 2000, pp. 4B-1 - 4B-18; In English; See also 20000039703; Copyright Waived; Avail: CASI; A03, Hardcopy

The requirements for accurate measurements, the higher sophistication in the design, the need for monitoring, control and diagnostics in difficult circumstances and the request for data bases to validate numerical codes have incited the advanced measurement techniques to the investigation of ground test facilities. This lecture presents an experimental work and the results obtained by Laser Induced Fluorescence (LIF) in continuous high enthalpy supersonic airflows. The test campaign is performed at the Central Research Institute of Machine Building (Tsniimach, Moscow region) in ground experimental facilities designed for aerodynamics and heat transfer studies of supersonic and hypersonic aircrafts. The main objective of this test campaign was to perform measurements of species concentrations, temperature and velocity in the incoming flow, and in the boundary and shock layers over a Thermal Protection System (TPS) model simulating a misalignment of tiles, by means of techniques developed by the plasma team from the University of Rouen. So, an original method using LIF diagnostic has been implemented to measure simultaneously the three parameters. Fluorescence of NO was induced in the high enthalpy air plasma flow by a tunable ArF-excimer laser via the epsilon-band system D(exp 2)sigma(+) (sub nu = 0) left arrow Chi(exp 2)Pi(sub nu = 1). Measurements of the rotational temperature and NO number density have been performed. The spatial resolution of the LIF technique permitted accurate characterization of the boundary and shock layer, as well as shock thickness. Finally, flow velocity is deduced from the Doppler-shift measurements of excited rovibrational NOE band. Analysis of the results will allow to assess the validity of the computational tools in order to control the representativity of future industrial tests devoted to local aerodynamic studies.
Derived from text
Aerodynamic Heat Transfer; Diagnosis; Ground Tests; Laser Induced Fluorescence; Research Facilities; Software Development Tools; Temperature Measurement; Thermal Protection

37
MECHANICAL ENGINEERING

20000020831 Rolls-Royce Ltd., Coventry, Industrial and Marine Gas Turbines, West Midlands, UK
ADVANCES IN A GAS TURBINE SYSTEM FOR SHIP PROPULSION
Parker, M. L., Rolls-Royce Ltd., Coventry, UK; MacLeod, P. K., Rolls-Royce Ltd., Coventry, UK; Coulson, M., Rolls-Royce Ltd., Coventry, UK; Gas Turbine Engine Combustion, Emissions and Alternative Fuels; June 1999, pp. 2-1 - 2-9; In English; See also 20000020829; Copyright Waived; Avail: CASI; A02, Hardcopy; A06, Microfiche

For thirty years, the obvious advantages of gas turbines in marine propulsion systems have been fully exploited by many of the world's navies. Conventional naval gas turbine propulsion systems utilize cruise engines (either a diesel or a gas turbine) to provide low speed fuel economy together with a boost gas turbine to provide the high power for top speeds. Fuel efficiency improvements in marine gas turbines have generally progressed in line with aero engine technology advancement. The potential for substantial fuel savings in the future is available through the adoption of complex cycle engines. An intercooled and recuperated (ICR) gas turbine, known as the RM60, went to sea in HMS Grey Goose (the world's first warship to rely entirely upon gas turbine propulsion) in 1953 and continued in service for over 4 years. The RM60, however was not viable for long term production due to its size and technical complexity. The only advanced cycle marine gas turbine currently in development is the intercooled and recuperated WR-21, the development of which is being funded by the USA Navy, the Royal Navy, and French Navy. The highly efficient WR-21, rate at 25.2 MW (ISO), is derived from the Rolls-Royce aero RB211 and latest Trent family of jet engines components being suitably adapted for marine environment. In addition modifications are necessary to integrate the heat exchangers and hot-end variable geometry in an effective manner. The imminent re-introduction of an advanced cycle marine gas turbine will radically improve fuel consumption by up to 30% when averaged over a typical naval duty cycle. This fuel saving, in conjunction with current condition-based maintenance techniques, engine modularization and the potential for retrofit of an ultra-low emission combustion system should cause a re-examination of the dominance of the diesel in many commercial marine applications. The combustion system requirements for the ICR cycle differ significantly from those of a conventional gas turbine, both in terms of aerodynamic and thermal characteristics of the cycle and also the overall system architecture. This paper summarizes the aerodynamic and mechanical design, rig verification, and development engine experience on the WR-21 combustion system to the present time.
Derived from text
Marine Propulsion; Propulsion System Configurations; Propulsion System Performance; Fuel Consumption; Gas Turbine Engines; Engine Design; Engine Parts

20000020832 Naval Air Systems Command, Patuxent , MD USA
TECHNICAL CHALLENGES ASSOCIATED WITH THE DEVELOPMENT OF ADVANCED COMBUSTION SYSTEMS
VanErp, Christopher A., Naval Air Systems Command, USA; Richman, Marcus H., Naval Air Systems Command, USA; Gas Turbine Engine Combustion, Emissions and Alternative Fuels; June 1999, pp. 3-1 - 3-5; In English; See also 20000020829; Copyright Waived; Avail: CASI; A01, Hardcopy; A06, Microfiche

The U.S. Navy, as a participant in the USA' Integrated High Performance Turbine Engine Technology (IHPTET) initiative, is dedicated to increasing aircraft engine performance to satisfy the propulsion requirements of future Navy aircraft. This is accomplished by identifying the propulsion requirements, in terms of performance and total cost, for specific Navy aircraft. The required engine technology advances are then broken down into specific engine component technology objectives. Advanced technology is then developed on the component level. Once an appropriate level of readiness is reached, the components are then assemble into an engine for an overall advanced propulsion system demonstration. Technologies from this demonstrator engine are then made available to development engine programs, such as the Joint Strike Fighter (JSF), for further development and eventual transition to production engine programs. The figure of merit used to measure performance is engine thrust/weight ratio. The role of the combustor in this endeavor is to provide the necessary temperature rise to increase core engine output. This drives the combustor to operate at higher fuel/air ratios which in turn drives a larger portion of the combustor volume to operate at or near stoichiometric conditions. Combustor operation at these levels must be achieved with an eye to numerous other parameters such as durability, weight, cost and emissions. The technical challenges presented in attempting to meet these oh objectives simultaneously are the subject of this paper.
Derived from text
Aircraft Engines; Combustion Chambers; Engine Design; Gas Turbine Engines; Propulsion

20000020836 United Technologies Research Center, Aeromechanical, Chemical and Fluid Systems, East Hartford, CT USA
MEASUREMENT OF SPRAY/ACOUSTIC COUPLING IN GAS TURBINE FUEL INJECTORS
Anderson, Torger J., United Technologies Research Center, USA; Kendrick, Donald W., United Technologies Research Center, USA; Cohen, Jeffrey M., United Technologies Research Center, USA; Rosfjord, Thomas J., United Technologies Research Center, USA; Gas Turbine Engine Combustion, Emissions and Alternative Fuels; June 1999, pp. 9-1 - 9-9; In English; See also 20000020829; Copyright Waived; Avail: CASI; A02, Hardcopy; A06, Microfiche

A diagnostic to measure the acoustic coupling of air flow with a fuel injector spray has been developed and tested. The instrument measures the mass of fuel within a plane of the spray using planar laser-induced fluorescence. The signal is monitored continuously to measure mass flow fluctuations during acoustic excitation of the flow. A comparison with the acoustic signal provides a measure of the response of the spray to acoustic excitation for a given nozzle design. This paper describes the approach to acquiring a planar-integrated time-dependent signal for response measurements. Re-

sults for several nozzle designs are also presented.
Author
Fuel Injection; Air Flow; Gas Turbine Engines; Nozzle Design; Acoustic Coupling; Fuel Sprays; Laser Induced Fluorescence; Optical Measurement

20000020837 Rolls-Royce Ltd., Derby, UK
SOOT AND RADIATION MODELLING IN GAS TURBINE COMBUSTION CHAMBERS
Brocklehurst, H. T., Rolls-Royce Ltd., UK; Moss, J. B., Cranfield Univ., UK; Hurley, C. D., Defence Evaluation Research Agency, UK; Priddin, C. H., Rolls-Royce Ltd., UK; Gas Turbine Engine Combustion, Emissions and Alternative Fuels; June 1999, pp. 10-1 - 10-13; In English; See also 20000020829; Original contains color illustrations; Copyright Waived; Avail: CASI; A03, Hardcopy; A06, Microfiche

The processes of soot formation and burn-out in liquid-fuelled combustors at practically relevant operating conditions remain poorly understood despite their importance in relation to emissions and, through their influence on radiation, to liner durability and life. The development of simplified theoretical models, necessitated by the underlying physical and chemical complexity, incorporates substantial empiricism and is particularly sensitive to scaling and the calibration of model parameters. This is particularly evident in the application of these models to realistic geometries. Previous post processed soot calculations in gas turbine combustion chambers neglecting the effects of radiation have found that predicted soot levels are an order of magnitude too high in comparison to measurements at 6 bar. The situation is worse for full power conditions, where the increased pressure (over 40 bar) can lead to such large amounts of soot being produced, that more carbon is converted to soot than is available in the fuel. In addition, the soot models are not able to capture the measured level of oxidation between the the primary zone and the combustor exit. This paper describes further developments in the modelling of the sooting processes, where the rate of oxidation is captured more accurately and the effects of radiation are treated more completely. The soot is modelled using a flamelet-based approach employing computations of a kerosene laminar counter-flow flame which incorporates detailed reaction kinetics, and radiation heat loss calculated using the Discrete Transfer Radiation Model. The effects of radiation on both the soot chemistry and the flow pattern (via density changers) are modelled by using a family of flamelets each with a different amount of heat loss. The most appropriate flamelet is selected on the basis of the local computed enthalpy, including heat loss due to radiation. Comparisons are presented between model prediction and sampled measurements from a gas turbine combustor at 6 bar Uncertainties remain in relation to the effective soot aerosol surface area and hence the rate of soot hum-out. Encouraging progress is reported on the coupling between soot production and radiation heat transfer for purposes of wall heat flux production.
Author
Gas Turbine Engines; Mathematical Models; Radiation Effects; Combustion Chambers; Soot; Emission

20000020848 National Aerospace Lab., VH Dept., Amsterdam, Netherlands
MODELING THE EFFECTS OF OPERATING CONDITIONS AND ALTERNATIVE FUELS ON GAS TURBINE PERFORMANCE AND EMISSIONS
Visser, W. P. J., National Aerospace Lab., Netherlands; Kluiters, S. C. A., Technische Univ., Netherlands; Gas Turbine Engine Combustion, Emissions and Alternative Fuels; June 1999, pp. 21-1 - 21-11; In English; See also 20000020829; Copyright Waived; Avail: CASI; A03, Hardcopy; A06, Microfiche

With the increasing attention to gas turbine exhaust gas pollution, a need has emerged to assess effects of a variety of operational variables on the emission levels. An effective approach to address this need is to integrate combustor emission models in gas turbine performance models. NLR's generic gas turbine performance simulation environment (GSP) has therefore been extended with a number features for accurate analysis of these effects on the major exhaust gas emissions NO, CO, UHC and Smoke. First, GSP's gas model has been extended to include a detailed description of gas composition including the particular emission species. Second, a new generic multi-reactor combustor model has been developed for detailed modeling of the processes in a combustor. The combustor model is set up by defining a number of reactors modeling combustion, mixing. steam/water-injection and their effects on emission formation using semi-empirical models for the reaction kinetics. Fuel properties and composition can be specified in detail, enabling analysis of effects of alternative fuels on gas turbine engine performance and emissions. Preliminary validation results with the multi-reactor combustion model corresponded with measured emission data and with expected operating condition effects on emissions. With the NOx model best accuracy was obtained. The accuracy of particularly the CO, UHC and Smoke formation models may he improved by adapting the multi-reactor model to allow for modeling of effects such as film cooling and other effects not covered by a one-dimensional model. The current generic multi-reactor combustor module will be used for easy implementation of improved emission models in the future. This work will also involve extensive validation using detailed engine. combustor and emission data.
Author
Combustion; Gas Turbine Engines; Combustion Physics; Mathematical Models; Exhaust Emission; Exhaust Gases; Combustion Chambers

20010067714 Technische Univ., Brunswick, Germany
INVESTIGATION ON A SEMI-ACTIVE HYDRO MOUNT USING MR FLUID
Ay, R., Technische Univ., Germany; Golnaraghi, M. F., Waterloo Univ., Canada; Khajepour, A., Waterloo Univ., Canada; Active Control Technology for Enhanced Performance Operational Capabilities of Military Aircraft, Land Vehicles and Sea Vehicles; June 2001, pp. 15-1 - 15-10; In English; See also 20010067671; Original contains color illustrations; Copyright Waived; Avail: CASI; A02, Hardcopy

Hydraulic engine mounts (hydro mounts) are passive devices used to isolate automobile engine vibration from the chassis at different automobile operating conditions. In this paper we introduce a semi-active hydro mount, using Magneto Rheologic (MR) fluids. A semiactive hydro mount can be used to optimize the mount performance for a wider range of vehicle operating conditions. The MR fluid mount developed and mathematically modeled in this work can change its yield shear stress once under a magnetic field, and hence, it may be tuned by applying electromagnetic field. The tuning ability allows us to vary the natural frequency of the mount and to increase the damping of the mount. To verify the numerical results an experimental test bed has been developed. Preliminary results show that the experimental and numerical results correlate well.
Author
Shear Stress; Vibration; Automobile Engines; Supports; Magnetorheological Fluids

38
QUALITY ASSURANCE AND RELIABILITY

19990070404 Standard Aero Ltd., Winnipeg, Manitoba Canada
PROPELLER BARREL CAM LIFE EXTENSION
Tandon, Kedar, Standard Aero Ltd., Canada; Junkin, Brent, Standard Aero Ltd., Canada; Thomas, Wayne, Standard Aero Ltd., Canada; March 1999; 6p; In English; See also 19990070390; Copyright Waived; Avail: CASI; A02, Hardcopy; A02, Microfiche

Overhaul inspection instructions and acceptance criteria provided by the OEM are sometimes not adequate to assess the suitability of the part for continued service. Propeller barrel cams with helical cam tracks were found to have pitting on the surface, which caused the inspectors to reject them. An engineering analysis of the wear surface using scanning electron microscope and metallographic techniques was performed. Based on this analysis, the inspection data, (including techniques and interpretation) was re-evaluated. The careful evaluation of the service degradation damage resulted in an improvement of inspection methods and guidance material. The reject rate of the cams was dramatically reduced and thus their life was safely extended.
Author
Inspection; Microstructure; Cams; Pitting; Wear; Manuals; Maintenance; Equipment Specifications; Specifications

20000032870 Sikorsky Aircraft, Stratford, CT USA
FLAW TOLERANT SAFE-LIFE METHODOLOGY
Adams, D. O., Sikorsky Aircraft, USA; Application of Damage Tolerance Principles for Improved Airworthiness of Rotorcraft; February 2000, pp. 14 - 1 - 14 - 8; In English; See also 20000032859; Copyright Waived; Avail: CASI; A02, Hardcopy

Conventional safe-life methodology has been in general use in the helicopter industry for more than 40 years to substantiate fatigue-loaded dynamic components. However, it is seen to need improvement. One improvement is to reduce its sensitivity to the strength-reducing effects of flaws and defects that may occur in manufacturing and service use. Damage Tolerance methodology provides a means to accomplish this improvement but it is currently difficult to economically apply it to every fatigue mode on every component. Flaw Tolerant methodology is an available equal-choice option to Damage Tolerance for Transport Category civil rotorcraft, and it is offered here as a practical improvement to conventional safe life for military applications as well. Flaw Tolerance, which is based on the characteristics of initiation of cracks from flaws, is described and illustrated by means of examples of successful applications to helicopter components.
Author
Damage; Helicopters; Rotary Wing Aircraft; Tolerances (Mechanics); Helicopter Design; Aircraft Reliability; Aircraft Structures; Design Analysis; Cracks

20000032871 Eurocopter France, Etablissement de Marignane, Marignane, France
DAMAGE TOLERANCE APPLIED ON METALLIC COMPONENTS
Marquet, Thierry, Eurocopter France, France; Struzik, Alain, Eurocopter France, France; Application of Damage Tolerance Principles for Improved Airworthiness of Rotorcraft; February 2000, pp. 15 - 1 - 15 - 14; In English; See also 20000032859; Copyright Waived; Avail: CASI; A03, Hardcopy

New requirements including damage tolerance were inserted in FAR 29.571, amendment 28 in 1989 to increase the safety level of helicopters. (' Flaw tolerance safe life' and 'fail safe' - or a combination thereof, were proposed to fulfill the damage tolerance requirements. If unpractical, ' safe life ' evaluation was acceptable.) A working group called TOGAA was mandated by the US Senate to propose modifications to the FAA rules. Harmonised recommendations from rotorcraft manufacturers (RCWG) had been gathered in a 'White Paper'. The TOGAA commented this methodology and concluded in mid 1998, that the 'flaw tolerant safe life' concept should be purged in FAR 29, and advocated the exclusive use of crack propagation for single and multiple load paths. This paper presents EUROCOPTER's statistical analyses of the root causes of accident in flight. EUROCOPTER's philosophy in reply to FAR & JAR 29-571 is detailed, showing a significant and measurable improvement over conventional 'safe-life' methodology. This philosophy has already been applied to several current projects (EC 155, NH 90), and the RCWG simply wanted it to be left in the current rules.
Author
Damage; Tolerances (Mechanics); Statistical Analysis; Rotary Wing Aircraft; Helicopters; Crack Propagation; Metals; Aircraft Reliability; Helicopter Design; Design Analysis

20000119931 Royal Air Force, Logistics, Huntingdon, UK
WHAT THE CUSTOMER WANTS: MAINTENANCE-FREE AND FAILURE-FREE OPERATING PERIODS TO IMPROVE OVERALL SYSTEM AVAILABILITY AND RELIABILITY
Mitchell, P., Royal Air Force, UK; Design for Low Cost Operation and Support; September 2000, pp. 14-1 - 14-11; In English; See also 20000119918; Copyright Waived; Avail: CASI; A03, Hardcopy

The aim of this paper is to promote the philosophy of Maintenance/Failure-Free Operating Periods (M/F-FOP) as an additional methodology for the specification and assurance of defense equipment reliability.
Derived from text
Reliability; System Effectiveness; Availability; Operational Problems; Systems Engineering

20000119933 Aeronautical Systems Div., Wright-Patterson AFB, OH USA
A LOW COST APPROACH TO OSS AND E ASSURANCE THROUGHOUT A SYSTEM'S LIFE
Dulai, Ajmel S., Aeronautical Systems Div., USA; Design for Low Cost Operation and Support; September 2000, pp. 15-1 - 15-9; In English; See also 20000119918; Copyright Waived; Avail: CASI; A02, Hardcopy

In periods of declining budgets and downsizing, it becomes increasingly important to select the best possible design and development approaches that provide the desired life cycle cost benefits while sustaining system capability. Aging of the USA Air Force (USAF) systems, factored with efforts to extend their operational longevity, has an impact on the systems' safety and operational capabilities. On 3 December 1997, the commander of the Air Force Materiel Command (AFMC) chartered an integrated product team (IPT) to develop a cost-effective Air Force policy for assurance of operational safety, suitability, and effectiveness (OSS&E) of USAF systems. The team developed this new policy based on proven commercial and U.S. Government practices, processes, and methodologies in place today. A key element of this policy is the certification process that ensures airworthiness is established and maintained throughout the life of the system. The highlights of the policy and the selected processes, best practices, and methodologies are presented.
Author
Low Cost; Budgeting; Cost Effectiveness; Life Cycle Costs; Cost Analysis; Design To Cost; Systems Engineering

20010016871 State Univ. of New York, Dept. of Industrial Engineering, Buffalo, NY USA
HUMAN RELIABILITY IN CIVIL AIRCRAFT INSPECTION
Drury, C. G., State Univ. of New York, USA; The Human Factor in System Reliability: Is Human Performance Predictable?; January 2001, pp. 3-1 - 3-10; In English; See also 20010016868; Original contains color illustrations; Copyright Waived; Avail: CASI; A02, Hardcopy

Inspection of structures, systems, and engines is an important part of ensuring continued airworthiness of the civil aircraft fleet. This paper describes the airworthiness assurance system and considers applicable bodies of knowledge which help understand and predict aircraft inspection performance. Two examples of recent studies of aircraft inspectors are used to illustrate the extra depth and breadth of understanding available where such knowledge is applied to these tasks. It is concluded that perhaps we have two separate roles: (1) to predict performance and (2) to improve it. Quantitative prediction will never be complete, but better estimates of inspector variability help us set more realistic inspection intervals. However, for improving aircraft inspection tasks we should concentrate on broader contextual factors, despite our inability to quantify some of these effects.
Author
Aircraft Reliability; Inspection; Human Performance; Safety

20010019327 AverStar, Inc., Fairmont, WV USA
RELIABLE TAILORED-COTS VIA INDEPENDENT VERIFICATION AND VALIDATION
Beims, Michael A., AverStar, Inc., USA; Dabney, James B., AverStar, Inc., USA; Commercial Off-the-Shelf Products in Defence Applications 'The Ruthless Pursuit of COTS'; December 2000, pp. 10-1 - 10-7; In English; See also 20010019317
Report No.(s): ISBN 92-837-1049-5; Copyright Waived; Avail: CASI; A02, Hardcopy

An important class of Commercial Off-The-Shelf (COTS) applications is the adaptation of an established COTS product to an operational environment for which it was not originally intended. This tailoring of the established product can provide the expected cost-reduction benefits associated with COTS and still meet system reliability requirements when augmented with an appropriate Independent Verification and Validation (IV&V) activity. We illustrate the tailored-COTS IV&V approach using the integration of a COTS Global Positioning System (GPS) receiver into the Space Shuttle onboard avionics system. The COTS GPS receiver chosen is a proven, reliable navigation aid that has been successfully integrated in numerous military aircraft, ranging from helicopters to jet fighters. However, integration of this COTS receiver into the Space Shuttle avionics system required many changes due to the different avionics hardware environment and the dramatically different flight environ-

ment. The key elements of the tailored-COTS IV&V approach are identification of unchanged but operationally affected code, development of automated code analysis tools, software scenario analysis, and exploitation of historical databases.
Author
Computer Programs; Exploitation; Commercialization; Technology Utilization

20010028489 R-Tec, Rolling Hills Estates, CA USA
INSPECTION TECHNOLOGIES
Ratwani, Mohan M., R-Tec, USA; Aging Aircraft Fleets: Structural and Other Subsystem Aspects; March 2001, pp. 14-1 - 14-17; In English; See also 20010028476; Original contains color illustrations; Copyright Waived; Avail: CASI; A03, Hardcopy

Regular maintenance of airframe is an important aspect of assuring flight safety of aircraft structures. One technology area, which plays an important role in proper maintenance and assuring the flight safety of aircraft, is the inspection at regular intervals. Reliable visual and nondestructive inspection (NDI) methods are needed to assure the airworthiness of these aircraft and at the same time keeping maintenance costs to a minimum. Commercial aircraft maintenance programs are shown in Figure 1. For military aircraft the inspection requirements are generally defined by Integrated Logistic Support (ILS) organization for non-critical components. For critical components, the inspections are defined by damage tolerance analysis.
Derived from text
Airframes; Aircraft Maintenance; Aircraft Structures; Inspection; Aircraft Reliability

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STRUCTURAL MECHANICS

19990026321 Industrieanlagen-Betriebsgesellschaft m.b.H., Ottobrunn, Germany
CORROSION FATIGUE OF STRUCTURAL COMPONENTS
Schuetz, Walter, Industrieanlagen-Betriebsgesellschaft m.b.H., Germany; Fatigue in the Presence of Corrosion; March 1999; 9p; In English; See also 19990026320; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

Corrosion fatigue is a very complex phenomenon, because two very different loading systems are acting together. In addition, its correct simulation in the lab- while relatively easy, if expensive, for fatigue alone - is nearly impossible for cost and duration reasons. Also, little is known about the corrosion environment of aircraft (and of ground vehicles). Components, always notched, behave differently from unnotched material specimens in corrosion fatigue. Therefore, materials tests are useless, it is necessary to test components, with their protection system, under the relevant variable amplitude stress-time history and to simulate also the typical sequence; Corrosion-Corrosion Fatigue-Corrosion etc., in order to obtain a result which corresponds to the real behaviour in service. This has never been done up to now - and would be very expensive anyway. One way out of this problem would be to corrosion-fatigue test components which have suffered corrosion damage in service. This has been done a number of times, as some papers in this Workshop show. Finally a number of rules for improving corrosion fatigue tests in the lab are presented, including the suggestion to fit 'corrosion boxes' to some typical components of an aircraft during it's full scale fatigue test.
Author
Fatigue (Materials); Corrosion; Structural Failure; Aircraft Reliability; Aircraft Maintenance; Aircraft Structures; Fatigue Tests; Full Scale Tests; Corrosion Tests; Simulation

19990026325 Institute for Aerospace Research, Ottawa, Ontario Canada
LOCAL STRESS EFFECTS OF CORROSION IN LAP SPLICES
Komorowski, J. P., Institute for Aerospace Research, Canada; Bellinger, N. C., Institute for Aerospace Research, Canada; Gould, R. W., Institute for Aerospace Research, Canada; Fatigue in the Presence of Corrosion; March 1999; 8p; In English; See also 19990026320; Sponsored in part by NCI Information Systems; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

Corrosion pillowing in fuselage joints has been modelled using finite element techniques and close-form solutions and shown to result in very high stress, which may lead to non-surface breaking high aspect ratio cracks. These cracks have been identified in a number of transport aircraft. Fractographic studies identified intergranular corrosion and in some cases fatigue striations at the crack front. Corrosion may have a greater impact on the structural integrity of joints than previously recognized and may require durability and damage tolerance reassessments including corrosion damage scenarios.
Author
Fatigue (Materials); Structural Failure; Aircraft Maintenance; Cracks; Finite Element Method; Fuselages; Intergranular Corrosion; Stress Corrosion; Transport Aircraft; Lap Joints; Splicing

19990026337 Dayton Univ. Research Inst., OH USA
RISK ASSESSMENT OF FATIGUE CRACKS IN CORRODED LAP JOINTS
Berens, Alan P., Dayton Univ. Research Inst., USA; West, J. Doug, Boeing Defense and Space Group, USA; Trego, Angela, Boeing Defense and Space Group, USA; Fatigue in the Presence of Corrosion; March 1999; 10p; In English; See also 19990026320; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

As part of a program to develop analytical tools for predicting and validating the effects of corrosion on fatigue life assessments, deterministic crack growth predictions were made for a test specimen that is representative of a transport fuselage lap joint. Fatigue tests had been performed using this specimen and the results were made available by the National Research Council of Canada. The test data provided the necessary information to define boundary conditions, cracking scenarios, and initiating crack size distributions as well as to validate predictions. In addition to corrosion severity, which was modeled by the metric of uniform material thinning, the crack growth predictions also had to account for multiple site damage. This paper uses the lap joint specimen test data and the deterministic crack growth predictions to demonstrate a risk analysis approach for quantifying random effects of factors associated with corrosion damage. Stress intensity factors and crack growth are calculated for selected percentiles of assumed distributions of corrosive thinning. Output from these deterministic analyses are then used in the risk analysis program Probability Of Fracture (PROF) to calculate conditional failure probability as a function of experienced cycles for the multiple sets of defined conditions. The results are interpreted by a comparison of risks for the various degrees of thinning and by an implied distribution of hours to reach a fixed failure probability for the assumed distributions of corrosive thinning.
Author
Fatigue Tests; Corrosion; Structural Failure; Crack Propagation; Cracks; Fatigue Life; Lap Joints; Fuselages; Fracturing

20000032861 Defence and Evaluation Research Agency, Farnborough, UK
THE DEVELOPMENT OF A ROBUST CRACK GROWTH MODEL FOR ROTORCRAFT METALLIC STRUCTURES
Cook, R, Defence and Evaluation Research Agency, UK; Wood, P. C., Westland Helicopters Ltd., UK; Jenkins, S., Westland Helicopters Ltd., UK; Matthew, D., Westland Helicopters Ltd., UK; Irving, P., Cranfield Univ., UK; Austen, I., nCode International Ltd., UK; Buller, R., Westland Design Services Ltd., UK; Application of Damage Tolerance Principles for Improved Airworthiness of Rotorcraft; February 2000, pp. 3 - 1 - 3 - 11; In English; See also 20000032859; Original contains color illustrations; Copyright Waived; Avail: CASI; A03, Hardcopy

In the UK, helicopters have traditionally been designed using safe life principles. However, proposed changes to the airworthiness regulations require that, in the future, structures are qualified using flaw growth methods. Therefore, a robust crack growth model is required. A collaborative project has been undertaken by GKN Westland Helicopters, DERA, Cranfield University and nCode International to develop such a model and define the methodologies required for its implementation. The work was funded by the Department of Trade and Industry and the Ministry of Defence whose support is gratefully acknowledged. This report describes work carried out in the collaborative project and the recommendations formulated. The project consisted of six main areas of investigation

namely the derivation of stress intensity factors, determination of typical flight load sequences, measurement of fracture mechanics material properties for use in models. measurement of crack growth data for model verification; evaluation and development of crack growth models, and definition of a helicopter damage tolerance methodology. The project considered two areas of helicopter design, these are: (1) a dynamic rotating component found in a rotorhead; and (2) a typical structural feature in the main load path lift frames. The two areas are fundamentally different and involve different materials and loading actions which may therefore, require different damage tolerance approaches. In this paper each of the six areas of investigation are described, with the main focus on the development and evaluation of crack growth models. The approach used for model development and evaluation was to increase gradually the complexity of the loaded structure. Initially simple compact tension coupons subjected to constant amplitude loading were studied and models were evaluated against test measurements. The complexity of the loading was increased to include discrete loading events, compressive loading events, and finally two representative flight load sequences, Asterix and Rotorix, which were developed during the project. The complexity of the components was also increased, to include part through thickness cracks and finally structural elements representative of features in a rotorhead mast and an area of a main lift frame. At each of these stages, the models were evaluated against experimental measurements. From the results of the investigation, an overall methodology was developed for damage tolerance assessments, although a number of areas require further investigation. The applications and limitations of the approach are presented and recommendations for further work made.
Derived from text
Crack Propagation; Mathematical Models; Metals; Rotary Wing Aircraft; Tolerances (Mechanics); Helicopter Design; Fracture Mechanics; Cracks; Aircraft Structures

20000032873 Department of the Air Force, Engineering Directorate, Wright-Patterson AFB, OH USA
TREATMENT OF HIGH-CYCLE VIBRATORY STRESS IN ROTORCRAFT DAMAGE TOLERANCE DESIGN
Lincoln, John W., Department of the Air Force, USA; Yeh, Hsing C., Department of the Air Force, USA; Application of Damage Tolerance Principles for Improved Airworthiness of Rotorcraft; February 2000, pp. 18 - 1 - 18 - 10; In English; See also 20000032859; Copyright Waived; Avail: CASI; A02, Hardcopy

Fixed wing aircraft manufacturers have adopted the damage tolerance design philosophy with great success for both military and commercial aircraft. However, rotorcraft manufacturers currently still primarily use the classical safe life approach or a modification thereof. One reason for this is that, at this time, no clearly defined damage tolerance design criteria exist for rotorcraft structures because of the analysis and test problems associated with the high cycle loading environment. This paper describes a study performed by the USA Air Force (USAF) to assess the impact of the damage tolerance approach on the design of a rotorcraft component affected by high-cycle vibratory stresses. The assessment consisted of developing the stress spectrum for a critical rotor system location and performing fracture analyses to determine the potential for establishing inspection intervals based on the damage tolerance approach. They performed sensitivity studies to determine the maximum range truncation that would yield results with acceptable accuracy. They considered the influence of the small-crack effect in all fracture mechanics calculations. The resulting crack growth functions provided the basis for establishing whether an inspection program was viable for the component. They examined the effect of stress reduction measures such as shot peening to enhance the damage tolerance capability of highly stressed components. Therefore, the paper identifies the main issues related to the use of damage tolerance for rotorcraft, and additionally makes recommendations for rotorcraft design criteria.
Author
Helicopter Design; Design Analysis; Cracks; Rotary Wing Aircraft; Fracture Mechanics; Fracturing; Tolerances (Mechanics); Damage; Stress Cycles

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GEOSCIENCES (GENERAL)

20000047263 Research and Technology Organization, Studies, Analysis and Simulation Panel, Neuilly-sur-Seine, France
APPROACHES TO THE IMPLEMENTATION OF ENVIRONMENT POLLUTION PREVENTION TECHNOLOGIES AT MILITARY BASES *[APPROCHES DE L'APPLICATION DES TECHNIQUES DE PREVENTION DE LA POLLUTION SUR LES BASES MILITAIRES]*
Approaches to the Implementation of Environment Pollution Prevention Technologies at Military Bases; April 2000; 343p; In English; Symposium of the RTO Studies, Analysis and Simulation Panel: Approaches to the Implementation of Environment Pollution Prevention Technologies at Military Bases; 5-7 May 1999, Budapest, Hungary; See also 20000047264 through 20000047289; CD-ROM: CD-ROM contains the entire document presented in PDF format
Report No.(s): RTO-MP-39; AC/323(SAS)TP/14; ISBN 92-837-1025-8; Copyright Waived; Avail: CASI; C01, CD-ROM; A15, Hardcopy; A03, Microfiche

Military operations within the framework of Environment Security are largely dependent on conformance with national and international laws or agreements to protect the air, water and ground resources. Pollution must be controlled, modified, or eliminated at the source. Society is paying a very high price today to restore and reclaim resources that have been subject to wanton pollution for many years by both military and civilian users. Many NATO and Partnership for Peace operations and training exercises are now being constrained by national and international environmental laws. Military forces, air, land and sea, must be enabled to operate and train under a wide variety of conditions. Serious consideration must be given to compliance with the body of environmental law either in existence or now being written. Pollution Prevention activities will ensure the ability to continue operation without undue penalty or restriction.
Author
Environment Pollution; Environment Protection; Military Operations; Pollution Control

20010012824 Research and Technology Organization, Sensors and Electronics Technology Panel, Neuilly-sur-Seine, France
SPACE-BASED OBSERVATION TECHNOLOGY *[LES TECHNOLOGIES DE L'OBSERVATION SPATIALE]*
October 2000; 245p; In English; Space-Based Observation Technology; 16-18 Oct. 2000, Samos, Greece; See also 20010012825 through 20010012851; CD-ROM contains full text document in PDF format; Original contains color illustrations
Report No.(s): RTO-MP-61; AC/323(SET)TP/14; ISBN 92-837-1050-9; Copyright Waived; Avail: CASI; A11, Hardcopy; A03, Microfiche; C01, CD-ROM

Observation of the earth by use of spacebased sensors has a large number of advantages compared with ground-based or airborne sensors. It is, therefore, a primary requirement of future reconnaissance systems, and is thus also a primary requirement of future reconnaissance systems of NATO. There is a tendency worldwide to place in space many reconnaissance functions that have so far been fulfilled by airborne systems. Spaceborne sensors are in essence optical and radar sensors. Optics have the property of high geometric resolution, but fail during the night and under adverse weather conditions. Radar can penetrate weather, dust and even foliage. The resolution achieved nowadays with Synthetic Aperture Radar (SAR) technology comes close to that of optical resolution. SAR offers additional features such as classification based on Doppler or polarimetry, moving target detection, 3D-imaging etc. Sensors installed on a spacecraft have to fulfill various conditions which have to do with the space environment. Light weight, low-power power consumption, small size are prerequisites. Moreover, components have to be space-proof. Signal and image processing techniques and technology for on-board real-time processing have to be considered as well. Starting from operational requirements this symposium summarizes aspects of spaceborne radar, including the required technology as well as special features, signal and data processing, optronics instrumentation and detector technology, so as to cover the whole range of spacebased observation technology

based on radar and optronics. Various existing or planned observation satellite projects are described.
Author
Conferences; Spaceborne Lasers; Electro-Optics; Radar Detection; Target Acquisition; Target Recognition; Artificial Satellites; Synthetic Aperture Radar; Space Based Radar; Remote Sensing

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EARTH RESOURCES AND REMOTE SENSING

20000032651 Research and Technology Organization, Systems Concepts and Integration Panel, Neuilly-sur-Seine, France
SEARCH AND TARGET ACQUISITION *[RECHERCHE ET ACQUISITION D'OBJECTIFS]*
March 2000; 241p; In English; 21-23 Jun. 1999, Utrecht, Netherlands; See also 20000032652 through 20000032676
Report No.(s): RTO-MP-45; AC/323(SCI)TP/19; ISBN 92-837-1035-5; Copyright Waived; Avail: CASI; A11, Hardcopy; A03, Microfiche; C01, CD-ROM

This volume contains the Technical Evaluation Report, the Keynote Address, and the 26 unclassified papers, presented at the Workshop on Search and Target Acquisition, that was organised by the Systems Concepts and Integration (SCI) Panel 12 (the former RSG-2), on 'Camouflage, Concealment and Deception Evaluation Techniques', and that was held in Utreacht, the Netherlands, from 21-23 June 1999. The paper presented covered the following headings: search performance predictions, target acquisition mechanisms, and simulation issues
Derived from text
Conferences; Camouflage; Target Acquisition; Simulation; Detection; Performance Prediction; Tracking (Position)

20000032652 Georgia Tech Research Inst., Electro-Optics, Environment and Materials Lab., Atlanta, GA USA
LESSONS LEARNED IN DEVELOPING AND VALIDATING MODELS OF VISUAL SEARCH AND TARGET ACQUISITION
Doll, Theodore J., Georgia Tech Research Inst., USA; Home, Richard, Defence Evaluation Research Agency, UK; Search and Target Acquisition; March 2000, pp. 1-1 - 1-8; In English; See also 20000032651; Copyright Waived; Avail: CASI; A02, Hardcopy

Some shortcomings of past and current approaches for modeling human visual search and target acquisition (STA) are discussed. The effects of complex pattern perception, visual attention, learning, and cognition on STA performance are particularly emphasized. The importance of these processes is explained and approaches are suggested for modeling them. Guidelines are also provided for testing and validating models of visual search and target acquisition. These guidelines take into account the roles of pattern perception, visual attention, learning, and cognition in STA performance. The present paper also presents and compares alternative approaches to field testing for the purpose of model validation.
Author
Target Acquisition; Tracking (Position); Cognition; Detection; Target Recognition; Signature Analysis

20000032653 Granada Univ., Dept. de Ciencias de la Computacion e I.A., Spain
VISUAL DISTINCTNESS DETERMINED BY PARTIALLY INVARIANT FEATURES
Garcia, J. A., Granada Univ., Spain; Fdez-Valdivia, J., Granada Univ., Spain; Fdez-Vidal, Xose R., Santiago Univ., Spain; Rodriguez-Sanchez, Rosa, Jaen Univ., Spain; Search and Target Acquisition; March 2000, pp. 2-1 - 2-12; In English; See also 20000032651
Contract(s)/Grant(s): CICYT-TIC97-1150; Copyright Waived; Avail: CASI; A03, Hardcopy

This paper describes a system for the automatically learned partitioning of 'visual patterns' in digital images, based on a sophisticated, band-pass, filtering operation, with fixed scale and orientation sensitivity. The 'visual patterns' are defined as the features which have the highest degree of alignment in the statistical structure across different frequency bands. Here we show a computational visual distinctness measure computed from the image representational model based on visual patterns. It is applied to quantify the visual distinctness of targets in complex natural scenes. We also investigate the relation between the computational distinctness measure and the visual target distinctness measured by human observers.
Author
Images; Statistical Analysis; Detection; Target Acquisition; Viewing; Bandpass Filters; Tracking Filters; Optical Tracking

20000032654 California Inst. of Tech., Computation and Neural Systems Program, Pasadena, CA USA
TARGET DETECTION USING SALIENCY-BASED ATTENTION
Itti, Laurent, California Inst. of Tech., USA; Koch, Christof, California Inst. of Tech., USA; Search and Target Acquisition; March 2000, pp. 3-1 - 3-10; In English; See also 20000032651; Sponsored in part by HIMH; Copyright Waived; Avail: CASI; A02, Hardcopy

Most models of visual search, whether involving overt eye movements or covert shifts of attention, are based on the concept of a 'saliency map', that is, an explicit two-dimensional map that encodes the saliency or conspicuity of objects in the visual environment. Competition among neurons in this map gives rise to a single winning location that corresponds to the next attended target. Inhibiting this location automatically allows the system to attend to the next most salient location. We describe a detailed computer implementation of such a scheme, focusing on the problem of combining information across modalities, here orientation, intensity and color information, in a purely stimulus-driven manner. We have successfully applied this model to a wide range of target detection tasks, using synthetic and natural stimuli. Performance has however remained difficult to objectively evaluate on natural scenes, because no objective reference was available for comparison. We here present predicted search times for our model on the Search2 database of rural scenes containing a military vehicle. Overall, we found a poor correlation between human and model search times. Further analysis however revealed that in 314 of the images, the model appeared to detect the target faster than humans (for comparison, we calibrated the model's arbitrary internal time frame such that no more than 2-4 image locations were visited per second). It hence seems that this model, which had originally been designed not to find small, hidden military vehicles, but rather to find the few most obviously conspicuous objects in an image, performed as an efficient target detector on the Search2 dataset.
Author
Target Acquisition; Mathematical Models; Image Processing; Optical Tracking; Target Recognition; Computer Techniques

20000032655 Army Communications-Electronics Command, Night Vision and Electronic Sensors Directorate, Fort Belvoir, VA USA
APPLYING THE LAW OF COMPARATIVE JUDGEMENT TO TARGET SIGNATURE EVALUATION
McManamey, James R., Army Communications-Electronics Command, USA; Search and Target Acquisition; March 2000, pp. 4-1 - 4-8; In English; See also 20000032651; Copyright Waived; Avail: CASI; A02, Hardcopy

The Law of Comparative Judgement (LCJ) is a psychophysical tool that can be used to scale complex phenomena that lack easily identified physical parameters. Target signatures represent such phenomena. In a demonstration exercise, a 'search difficulty' value was found using the LCJ. These LCJ scale values were compared to search times and probabilities of detection from a search experiment run in the Netherlands. The scale values were not linearly related to search time and probability of detection, but correlated very well with the logarithm of mean search time ($r = 0.936$) and the cube of the number of correct responses ($r = 0.954$). A chi-squared goodness-of-fit test gave 94.6% confidence in the fit of the LCJ scale to the experimental data. While the LCJ results in a scale with no natural zero point and arbitrary units, this tool can be used to construct a standard scale. This paper illustrates how a standard clutter scale might be constructed using the LCJ. The LCJ could be a valuable tool in target signature evaluation either when used in conjunction with scaling equations that permit conversion to familiar quantities such as mean search time and probability of detection, by providing relative 'search difficulty' values, or by making possible a psychophysically meaningful clutter scale.
Author
Target Acquisition; Clutter; Detection; Optical Tracking; Performance Prediction; Signature Analysis; Scene Analysis

20000032656 Danish Defence Research Establishment, Copenhagen, Denmark
CAMEVA: A METHODOLOGY FOR ESTIMATION OF TARGET DETECTABILITY
Birkemark, Christian M., Danish Defence Research Establishment, Denmark; Search and Target Acquisition; March 2000, pp. 5-1 - 5-8; In English; See also 20000032651; Copyright Waived; Avail: CASI; A02, Hardcopy

This paper will present a methodology for computerized evaluation of camouflage effectiveness. The methodology is implemented in software at Danish Defence Research Establishment (DDRE) under the acronym CAMEVA. Basic input is a single image comprising a highly resolved static target as well as a proper amount of representative background. Separate target and background images can also be handled. Target and background regions are manually selected using the computer's standard pointing device (i.e. the mouse). From the input data, CAMEVA predicts the target detectability as a function of the target distance. The detectability estimate is based on statistical distributions of features extracted from the imagery, establishing a multidimensional feature space. In the feature space, the Bhattacharyaa distance measure is applied as an estimator of the separability between the target and the background. The intention is that the extracted features should resemble those applied during the human perception process. Typically, contrast and various measures of edge strength are applied. The Bhattacharyaa distance establishes a relative separability, while the absolute detection range is obtained by deriving a relation between the Bhattacharyaa distance and the estimated target resolution, at range. Thus by introducing parameters of the sensor, typically the human unaided eye, detectability as a function of the range is obtained. The methodology will not reflect individual observer performance but is aimed at providing an estimate of the optimal detection performance, given the selected set of features. During the choice of features and of sensor parameters, other perception mechanisms, than the human observer performance, can be modelled with this methodology. The paper will discuss theoretical and practical aspects of CAMEVA. Validation and application examples, including results on the NATO RTO/SCI-012 SEARCH-I and SEARCH-2 datasets, will be presented together with other data.
Author
Camouflage; Computer Programs; Target Acquisition; Optical Tracking; Target Recognition; Statistical Analysis; Computerized Simulation

20000032657 Prince Edward Island Univ., Charlottetown, Prince Edward Island Canada
EVALUATION OF TARGET ACQUISITION DIFFICULTY USING RECOGNITION DISTANCE TO MEASURE REQUIRED RETINAL AREA
Nilsson, Thomy, Prince Edward Island Univ., Canada; Search and Target Acquisition; March 2000, pp. 6-1 - 6-12; In English; See also 20000032651; Copyright Waived; Avail: CASI; A03, Hardcopy

The psychophysical method of limits was used to measure the distance at which observers could distinguish military vehicles photographed in natural landscapes. Obtained from the TNO-TM Search-2 dataset, these pictures either were rear-projected 35 mm slides or were presented on a computer monitor. Based on the rational that more difficult vehicle targets would require more visual pathways for recognition, difficulty of acquisition was defined in terms of the relative retinal area required for recognition. Relative retinal area was derived from the inverse square of the recognition distance of a particular vehicle relative to the distance of the vehicle that could be seen furthest away. Results are compared with data on the time required to find the vehicles in these pictures. These comparisons indicate that: (1) the two methods are complementary with respect to distinguishing different degrees of acquisition difficulty; (2) recognition distance thresholds can be a suitable means of defining standards for the effectiveness of vital graphic information.
Author
Target Acquisition; Optical Tracking; Target Recognition; Performance Prediction; Distance; Position (Location)

20000032658 Ben Gurion Univ. of the Negev, Dept. of Electrical and Computer Engineering, Beersheva, Israel
EVALUATING TNO HUMAN TARGET DETECTION EXPERIMENTAL RESULTS AGREEMENT WITH VARIOUS IMAGE METRICS
Aviram, G., Ben Gurion Univ. of the Negev, Israel; Rotman, S. R., Ben Gurion Univ. of the Negev, Israel; Search and Target Acquisition; March 2000, pp. 7-1 - 7-6; In English; See also 20000032651; Copyright Waived; Avail: CASI; A02, Hardcopy

An evaluation of the agreement between experimental results of human target detection performance, as obtained by TNO - Human Factors Research Institute, and various image metrics is addressed in this paper. Image metrics, such as local target from background distinctness metrics (DOYLE and TARGET), a global image complexity metric (POE), and a textural global / local co-occurrence matrix metric (ICON), are presented and applied to the TNO image database. Good agreement, denoted by relatively high correlation levels, is found between the experimental results (search rates and probabilities of detection) and both DOYLE and TARGET local image metrics values. On the other hand, a relatively low correlation level is obtained between the experimental results and the POE global image metric values. Correlation values obtained using the global / local ICON metric are between these extremes, as expected. These results emphasize the dominance of the target to background distinctness perceptual cue and the appropriateness of the local metrics to this kind of imagery. Furthermore. they can be used to formulate empirical classification rules that can be used to evaluate and predict human detection performance in similar cases.
Author
Target Acquisition; Human Performance; Target Recognition; Optical Tracking; Psychophysiology

20000032659 Army Communications-Electronics Command, Fort Belvoir, VA USA
IMAGE BASED CONTRAST-TO-CLUTTER MODELING OF DETECTION
Wilson, David L., Army Communications-Electronics Command, USA; Search and Target Acquisition; March 2000, pp. 8-1 - 8-5; In English; See also 20000032651; Copyright Waived; Avail: CASI; A01, Hardcopy

Using image-based metrics, contrast-to-clutter modeling is applied to the Search-2 visible image set and perception experiment data. To calculate the contrast metric, a new image is generated from the original image by replacing the target with an 'expected background' using the local background surrounding the target and the natural horizontal correlation present in most surface-to-surface scenes. The contrast metric is obtained from the difference of this new image and the original image. Via a simple mathematical formula, the ratio of the contrast measure to a clutter metric is used to predict performance.
Author
Clutter; Image Analysis; Image Contrast; Mathematical Models; Target Acquisition; Performance Prediction; Imagery; Target Recognition

20000032660 Industrieanlagen-Betriebsgesellschaft m.b.H., Ottobrunn, Germany
EFFICIENT METHODS FOR VALIDATING TARGET ACQUISITION MODELS
Hecker, R., Industrieanlagen-Betriebsgesellschaft m.b.H., Germany; Search and Target Acquisition; March 2000, pp. 9-1 - 9-6; In English; See also 20000032651; Copyright Waived; Avail: CASI; A02, Hardcopy

On the basis of target acquisition fundamentals the camouflage assessment model CAMAELEON is presented and especially demands, principles and methods for validating the model. By indirect varying the distance to a target using zoom techniques of telescopes effective methods for validating the model have been developed in the visual range as well as in the infrared range. The paper presents the results of validation studies in the visual range and results of CAMAELEON model calculations with the SEARCH DATA image set made available by the TNO Human Factors Research Institute. The results are discussed on the basis of the underlying principles of the CAMAELEON model and the SEARCH DATA evaluations especially of visual lobe. Further investigations on the development of CAMAELEON are presented on the basis of the gathered experiences.
Author
Mathematical Models; Target Acquisition; Camouflage; Position (Location); Target Recognition; Optical Tracking; Visual Perception

20000032661 National Defence Research Establishment, Div. of Command and Control Warfare Technology, Linkoeping, Sweden
ASSESSING CAMOUFLAGE METHODS USING TEXTURAL FEATURES
Nyberg, Sten, National Defence Research Establishment, Sweden; Schutte, Klamer, Physics and Electronics Lab. TNO, Netherlands; Search and Target Acquisition; March 2000, pp. 10-1 - 10-10; In English; See also 20000032651; Copyright Waived; Avail: CASI; A02, Hardcopy

Developments in the area of signature suppression make it progressively more difficult to recognize targets. In order to obtain a sufficient low degree of false alarms it is necessary to observe spatial and spectral properties. There is a genuine need to use spatial properties when analyzing the difference between a target area and a background area. This is more relevant today since modern signature suppression techniques have focused on the reduction of distinct features, like hot spots in the infrared band. The approach is to apply texture descriptors to characterize the background and also more or less camouflaged targets. In addition, other descriptors are used to characterize man made objects. It is necessary to focus on features which discriminate targets from the background, and this demands a more precise description of the background and the targets than usual. The underlying assumption is that an area with more or less observable targets has different statistical properties from other areas. Statistical properties together with detected target specific features like straight lines, edges, corners or perhaps reflections from a window have to be combined with methods used in data fusion. Experiments with a computer program that estimates the statistical differences between targets and background are described. These differences are computed using a number of different distance measures. 44 images from the Search-2 image data set are used and mean search time and number of hits are predicted using textural features. The long term goal is to find methods for assessing signature suppression methods, especially in the infrared wavelength area.
Author
Camouflage; Computer Programs; Optical Tracking; Target Recognition; Statistical Distributions; Target Acquisition; Performance Prediction; Textures; Visual Perception

20000032662 NASA Ames Research Center, Moffett Field, CA USA
IMAGE DISCRIMINATION MODELS FOR OBJECT DETECTION IN NATURAL BACKGROUNDS
Ahumada, A. J., Jr., NASA Ames Research Center, USA; Search and Target Acquisition; March 2000, pp. 11-1 - 11-3; In English; See also 20000032651
Contract(s)/Grant(s): RTOP 548-50-12; Copyright Waived; Avail: CASI; A01, Hardcopy

This paper reviews work accomplished and in progress at NASA Ames relating to visual target detection. The focus is on image discrimination models, starting with Watson's pioneering development of a simple spatial model and progressing through this model's descendents and extensions. The application of image discrimination models to target detection will be described and results reviewed for Rohaly's vehicle target data and the Search 2 data. The paper concludes with a description of work we have done to model the process by which observers learn target templates and methods for elucidating those templates.
Author
Target Acquisition; Mathematical Models; Optical Tracking; Target Recognition; Discrimination; Image Processing; Visual Perception

20000032663 Turing Associates, Inc., Ann Arbor, MI USA
A CONTRAST METRIC FOR 3-D VEHICLES IN NATURAL LIGHTING
Witus, G., Turing Associates, Inc., USA; Gerhart, G., Army Tank-Automotive and Armaments Command, USA; Search and Target Acquisition; March 2000, pp. 12-1 - 12-10; In English; See also 20000032651
Contract(s)/Grant(s): DAAE07-97-C-X101; Copyright Waived; Avail: CASI; A02, Hardcopy

Ground vehicles in natural lighting tend to have significant and systematic variation in luminance over the presented area. This arises, in large part, from the vehicle surfaces having different orientations and shadowing relative to the source of illumination and the position of the observer. These systematic differences create the appearance of a structured 3-D object. 3-D appearance is an important factor in search, figure-ground segregation and object recognition. This paper presents a contrast metric based on the 3-D structure of the vehicle, and an analysis of search performance for the Search-2 imagery. The analysis employs the traditional P-infinity-times-negative-exponential model of search time distribution. P-infinity and mean search time are modeled as functions of the target signature. The signature metric is one over the product of vehicle size and contrast. The value of the metric is measured by the ability to account for variance in observed search performance. The 3-D structure contrast metric performs better than RSS contrast, and both perform dramatically better than the area- weighted average contrast. Target height performs better than either target area or square root of area. The signature metric accounts for over 80% of the variance in probability of detection and 75% of the variance in search time as measured in the TNO perception tests. When false alarm effects are discounted, the metric accounts for 89% of the variance in probability of detection and 95% of the variance in search time. The predictive power of the signature metric when it is calibrated to half the data and evaluated against the other half, is 90% of the explanatory power.
Author
Three Dimensional Bodies; Target Recognition; Optical Tracking; Luminance; Imagery; Mathematical Models; Surface Vehicles; Target Acquisition; Visual Perception; Image Contrast

20000032664 British Aerospace Aircraft Group, Bristol, UK
THE SOURCES OF VARIABILITY IN THE SEARCH PROCESS
Cooke, K., British Aerospace Aircraft Group, UK; Search and Target Acquisition; March 2000, pp. 14-1 - 14-12; In English; See also 20000032651; Copyright Waived; Avail: CASI; A03, Hardcopy

Modelling of camouflage concealment and detection, needs to consider the terrain in which a target will appear. A variety of capabilities for evaluating target signatures through to the human response now exists. The modelling approach adopted at British Aerospace research centre for many years has been a statistical one. Although image analysis techniques have been explored it has been cost effective for our purposes to stay with the statistical model ORACLE. A complex problem in modelling human visual performance is to find an adequate relationship between recognition thresholds across the visual field and simple target descriptions. The ORACLE model represents recognition as the resolution of a fraction of the target perimeter. The fractional perimeter concept has been applied further to representing average observer performance in structured scenes. Modelling of the SEARCH 2 data 2 was found to need a similar distribution of fractional perimeter values to a previous UK field trial. The use of a statistical lobe model for analysing search and recognition can be supported for generic information.
Author
Human Performance; Mathematical Models; Visual Perception; Optical Tracking; Target Recognition; Camouflage; Visual Observation

20000032665 Texas Univ., Dept. of Psychology, Austin, TX USA
IMAGE STRUCTURE MODELS OF TEXTURE AND CONTOUR VISIBILITY
Geisler, Wilson S., Texas Univ., USA; Thornton, Thomas, Texas Univ., USA; Gallogly, Donald P., Texas Univ., USA; Perry, Jeffrey S., Texas Univ., USA; Search and Target Acquisition; March 2000, pp. 15-1 - 15-8; In English; See also 20000032651; Copyright Waived; Avail: CASI; A02, Hardcopy

The perceptual mechanisms underlying texture and contour grouping/segregation play a dominant role in determining the visibility of targets in complex backgrounds. In most quantitative models of texture segregation the image is initially processed by channels selective along certain fundamental stimulus dimensions such as spatial frequency and orientation. These channels generally contain a nonlinearity, such as full-wave rectification, so that they signal the local contrast energy within the bandpass of the channel. Another stage of linear filtering, followed by a simple edge finding or thresholding mechanism, is then applied to the channel outputs to find the texture boundaries or regions. Although these channel-energy models have been successful in predicting texture segregation and discrimination performance for some classes of stimuli, there are large classes of stimuli that are readily segregated by human observers but which cannot be segregated by channel energy. The evidence suggests that more sophisticated models

incorporating perceptual organization mechanisms will be required to predict human texture and contour segregation performance. This paper describes new experimental evidence, and a working model which, in principle, can account for a wider range of human segregation and grouping capabilities. The premise of the model is that the visual system typically extracts rich descriptions of local image structure, and that it uses these descriptions for subsequent segregation and grouping. The model contains physiologically-based low level mechanisms for extracting primitives, matching mechanisms for detecting structural similarity, and grouping mechanisms for binding structural parts into wholes. Quantitative predictions of the model for contour segregation performance are presented.
Author
Mathematical Models; Visibility; Textures; Human Performance; Target Recognition; Contours; Visual Perception; Visual Observation

20000032666 Naval Postgraduate School, Dept. of Operations Research, Monterey, CA USA
COMPARING HUMAN TARGET DETECTION WITH MULTIDIMENSIONAL MATCHED FILTERING METHODS
Krebs, W. K., Naval Postgraduate School, USA; Scribner, D. A., Naval Research Lab., USA; McCarley, J. S., Naval Postgraduate School, USA; Ogawa, J. S., Naval Postgraduate School, USA; Sinai, M. J., Naval Postgraduate School, USA; Search and Target Acquisition; March 2000, pp. 16-1 - 16-7; In English; See also 20000032651; Copyright Waived; Avail: CASI; A02, Hardcopy

Recent technological advances in sensor manufacturing enable the use of separate spectral bands; e.g., MWIR and LWIR, to generate spatially registered imagery. Human factors experiments can be used to test whether a sensor can improve operator performance for detecting or recognizing a target. Although human factors experiments are of tremendous value, these tests are time consuming and resource intensive. In order to reduce costs associated with collecting behavioral data, an alternative approach is discussed. We propose using signal detection theory, to compliment and reduce the amount of classical human performance testing. As a test case we have studied whether multi-spectral sensors are significantly better than single band sensors. Scribner, Satyshur, and Kruer (1993) demonstrated that a two-dimensional matched filter (spatial) optimized for a specific target and background power spectra, can be used to estimate an observer's ability to detect the target embedded in a cluttered background. Three different background images were used with, and without, a target present. False alarm and target detection probabilities were computed and results were plotted on a Receiver Operating Characteristic (ROC) curve. The matched filter ROC curves were then compared to behavioral ROC curves. Results showed that the matched filter ROC curves were similar to behavioral ROC curves with color fusion and long-wave infrared showing the highest sensitivity and mid-wave and short-wave infrared scenes were significantly less sensitive. These results indicate that the matched filter analysis may be used to model human behavior.
Author
Operator Performance; Target Acquisition; Matched Filters; Signal Detection; Visual Perception; Visual Tasks; Target Recognition; Visual Observation; Imagery

20000032667 Army Materiel Systems Analysis Activity, Aberdeen Proving Ground, MD USA
DETECTION OF LOW-CONTRAST MOVING TARGETS
Mazz, John P., Army Materiel Systems Analysis Activity, USA; Kistner, Regina W., Army Materiel Systems Analysis Activity, USA; Pibil, William T., Army Materiel Systems Analysis Activity, USA; Search and Target Acquisition; March 2000, pp. 17-1 - 17-5; In English; See also 20000032651; Copyright Waived; Avail: CASI; A01, Hardcopy

The U.S. Army Materiel Systems Analysis Activity (USAMSAA) designed a perception experiment to assess the influence of target angular velocity on the detectability of low to moderate contrast targets. The Moving Target Experiment II (MTE II) was designed to be representative of search with the unaided eye. Target angular velocity, range, contrast, and background were varied. Targets with near-equal contrast at identical range and angular velocity yielded widely different probabilities of detection. However, within a specific background region, contrast had a significant impact. This localized impact of target contrast indicates that further improvements in search and target acquisition modeling requires the evaluation of scene-content's impact on target detection (i.e., what about the scene leads an observer to the vicinity of the target.) For low-contrast targets, scene content has even greater impact on detection. The U.S. Army's standard methodology for representing search and target acquisition in combat models is the ACQUIRE model, Current implementations of ACQUIRE utilize the 'two-thirds rule' to represent the detection of all moving targets regardless of angular velocity. The n50 for the detection of moving targets is simply 213 of the n50 used to represent the detection of stationary targets, Results of the MTE II and other experiments indicate that the appropriate ratio of moving-to-stationary n50 decreases as a function of angular velocity. A ratio of 2/3 equates to an angular velocity of 1 milli-radian/sec and a ratio of 113 equates to an angular velocity of 3.3 milli-radians/sec.
Author
Target Recognition; Moving Target Indicators; Visual Perception; Optical Tracking; Image Contrast; Mathematical Models; Visual Observation; Visual Acuity

20000032668 Harvard Medical School, Schepens Eye Research Inst., Boston, MA USA
VALIDATION AND VERIFICATION OF A VISUAL MODEL FOR CENTRAL AND PERIPHERAL VISION
Peli, Eli, Harvard Medical School, USA; Geri, George A., Raytheon Training and Services Co., USA; Search and Target Acquisition; March 2000, pp. 18-1 - 18-10; In English; See also 20000032651
Contract(s)/Grant(s): F41624-97-D-5000; NIH-EY-05957; NIH-EY-10285; Copyright Waived; Avail: CASI; A02, Hardcopy

Many computational visual models use the contrast sensitivity function (CSF) to represent certain visual characteristics of the observer. In addition, these models are often implemented using a multi-scale, band-limited representation of image contrast. The purpose of the present study was to evaluate a previously described visual model (Peli, JOSA A, 7, 2030, 1990) by comparing the appearance of an image viewed at various distances with simulations of that image corresponding to the same distances generated with the model. Among the unique characteristics of this model are that it applies a threshold (i.e. nonlinear) CSF and a locally normalized, band-limited contrast. Since CSFs can vary substantially depending both on the stimuli and the testing method used to measure them, the model was evaluated using several CSFs. The model was also evaluated for both central images, extending to 2 deg. eccentricity, and peripheral images, extending from 8 deg. to 32 deg. eccentricity. Changes in the images with eccentricity were modeled by a single parameter. For the central (2 deg.) stimuli, the CSF obtained with 1-octave Gabor stimuli and a contrast detection task provided better simulations than the other CSFs tested. In addition, data obtained using both lower and higher contrast versions of the same images verified the CSF over a wide range of frequencies and indicated that the model was sensitive to small variations in the chosen CSF. For the peripheral (6.4-32 deg.) stimuli, the same l-octave, detection CSF was found to provide the best simulation. In general, the model suggested by Peli (1990) performed well for both the central and peripheral visual targets, suggesting that the use of a nonlinear CSF and locally normalized contrast are valid. Further, the performance of the model for the peripheral stimuli suggests that, at least for the simple discrimination task used here, differences in image detail across wide-field images can be modeled using a single eccentricity-dependent parameter in addition to the foveal CSF.
Author
Mathematical Models; Simulation; Visual Perception; Peripheral Vision; Target Recognition; Visual Discrimination

20000032669 Physics and Electronics Lab. TNO, The Hague, Netherlands
MODELLING OF TARGET ACQUISITION WITHIN COMBAT SIMULATION AND WARGAMES
Vink, Jan, Physics and Electronics Lab. TNO, Netherlands; Search and Target Acquisition; March 2000, pp. 19-1 - 19-3; In English; See also 20000032651; Copyright Waived; Avail: CASI; A01, Hardcopy

This paper describes the target acquisition process from the perspective of modelling target acquisition as a part of modelling combat. Exchanging fire obviously is very important in combat. Conditions for direct fire are line-of-sight (LOS) and some kind of perception of the intended target. LOS is deterministic and can be calculated if there is a good digital representation of the terrain. But perception is considered a stochastic process with probabilities depending on the current situation. In most stochastic combat

simulation programmes and wargames there is a module that models detection and perception. Because of the dynamic character of combat situations for observing are changing rapidly. The models are calculating situations every x seconds (typical 5 - 30). Within such a timeframe occurrences of events and the effects of these events are calculated. Illustrative events are new observations, firings, etc. The target acquisition module is responsible for an actual list of observations. Each time-frame the list is updated: old observations are checked (observers or targets can be killed or moved) and new observations can be added. Because of the dynamic character only calculations are made for the coming time-frame. For each observer and each potential target an observation probability is calculated and comparison with a random number determines if the considered observer/target will lead to a new observation. Input for this module are elements of the situation at hand and characteristics of observer (such as the sensor used) and target (such as its dimensions). This paper addresses some of the limitations and problems of the current implementation of the target acquisition module.
Author
Mathematical Models; War Games; Target Acquisition; Simulation; Combat; Line Of Sight; Target Recognition

20000032673 Defence Clothing and Textiles Agency, Science and Technology Div., Colchester, UK
METHODS FOR DERIVING OPTIMUM COLOURS FOR CAMOUFLAGE PATTERNS
Mitchell, K. D., Defence Clothing and Textiles Agency, UK; Staples, C. R., Defence Clothing and Textiles Agency, UK; Search and Target Acquisition; March 2000, pp. 23-1 - 23-4; In English; See also 20000032651; Copyright Waived; Avail: CASI; A01, Hardcopy

The majority of camouflage patterns have been designed subjectively with only the colour aspect conforming to certain constraints such as average colour and luminance. Given the power of modern computing it should be possible to design scenario specific camouflage from calibrated colour imagery. The Defence Clothing and Textiles Agency is at present working on such a system. This capability will allow us to design and test patterns in a digital environment before field trials are carried out. This system will allow us to design patterns for specific scenarios such as coniferous treelines, deciduous treelines, summer, winter etc. It should also lead to highly effective patterns, as early validation can be carried out using a target detection model followed by photosimulation using a digital implantation technique. Once validated in the digital environment, a field trial using live observers can be carried out. In the design of a pattern, there are two major factors to take into account: the multi-level structure of a background and the many colours present. A method of designing scenario specific patterns needs to reduce the many hundreds of colours to a workable number of colour centres, usually between three and six. There is also the need to assess the structure present and produce a structure for the pattern, which should be multi-level to allow the pattern to be effective at various ranges. In this paper, we will review the results obtained from the initial study on reduction of the number of colours and colour centre choice.
Author
Camouflage; Target Acquisition; Color; Target Recognition; Imagery; Mathematical Models

20000047288 Industrieanlagen-Betriebsgesellschaft m.b.H., Div. for Environment and Management Systems, Ottobrunn, Germany
AIRBORNE SENSOR SURVEY FOR THE DETECTION OF HAZARDOUS SUBSTANCES AND OBJECTS IN THE SUBSURFACE
Klemm, Horst G., Industrieanlagen-Betriebsgesellschaft m.b.H., Germany; Schafer, Joerg, Industrieanlagen-Betriebsgesellschaft m.b.H., Germany; Approaches to the Implementation of Environment Pollution Prevention Technologies at Military Bases; April 2000, pp. 30-1 - 30-8; In English; See also 20000047263; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

In recent years there has been a surge of interest in methods for a rapid and reliable detection of unexploded ordnance (UXO) and other hazardous substances and objects in the subsurface. In Germany much of the motivation comes from recent environmental protection projects for the investigation and clean up of former military and industrial sites. The tremendous size of these areas to be investigated made it necessary to find innovative methods to get a rapid view of the contaminations for upcoming planning tasks and also to minimize the costs for necessary ground based surveys and clean up. Having been the prime contractor for a large project for the investigation of the contamination of more than 1000 former military sites of the West Group of the Russian Troops (WGT) in Eastern Germany the IABG gained an valuable amount of information and knowledge about the problems of the clean up of hazardous waste on military sites. As a result IABG started a research and development project using airborne sensor systems for the survey and detection of hazardous substances and UXO in 1997.
Author
Hazardous Materials; Ordnance; Environment Protection; Remote Sensing; Airborne Radar

20010012826 Alenia Spazio S.p.A., Remote Sensing Engineering, Rome, Italy
COSMO - SKYMED MISSION OVERVIEW
Caltagirone, F., Alenia Spazio S.p.A., Italy; Spera, P., Alenia Spazio S.p.A., Italy; Manoni, G., Italian Space Agency, Italy; Bianchi, Lucio, Ministry of Defence, Italy; Space-Based Observation Technology; October 2000, pp. 14-1 - 14-9; In English; See also 20010012824; Copyright Waived; Avail: CASI; A02, Hardcopy

COSMO - SkyMed is an end-to-end Earth Observation System dedicated to the remote sensing and data exploitation for Dual (military and civil) Use applications. Main mission objective is therefore the provision of data, products and services relevant to the: monitoring, surveillance and intelligence applications of MoD entities; and environmental monitoring, surveillance and risk management applications of institutional entities; environmental resources management, maritime management, earth topographic mapping, law enforcement, informative/science applications of other institutional, scientific and commercial entities. The program, presently funded by the Italian Space Agency (ASI) has been conceived since its very beginning to be implemented within an international scenario covering both the development of the infrastructures and utilization of the system. The purpose of this paper is to present an overview of the mission, the dual use concept design drivers, the current system architecture, the possible co-operation scenario, the deployment strategy and the current schedule.
Derived from text
End-To-End Data Systems; Data Processing; Remote Sensing; Military Technology

20010012827 Naval Research Lab., Washington, DC USA
NAVAL EARTHMAP OBSERVER (NEMO) HYPERSPECTRAL REMOTE SENSING PROGRAM
Wilson, Thomas, Naval Research Lab., USA; Felt, Robert, Naval Research Lab., USA; Baugh, Rebecca, Praxis, Inc., USA; Space-Based Observation Technology; October 2000, pp. 15-1 - 15-11; In English; See also 20010012824; Original contains color illustrations; Copyright Waived; Avail: CASI; A03, Hardcopy

The NEMO hyperspectral remote sensing program will provide unclassified, space-based hyperspectral passive imagery at moderate resolution that offers substantial potential for direct use by Naval forces and the Civil Sector. NEMO merges Navy-developed technology with commercial technology and provides a space-qualified hyperspectral imager with the coverage and sensitivity required to collect broad-area synoptic imagery over land and ocean on a global basis. NEMO is a joint government and industry effort between the Naval Research Laboratory (NRL) and its industry partner Space Technology Development Corporation (STDC). NEW is sponsored by the Office of Naval Research (ONR) and DARPA's Joint Dual-Use Application Program (JDUAP). NRL provides the design and integration of the NEMO sensor imaging payload with a commercial satellite bus as well as bus modifications, the on-board imaging processor, feature extraction and data compression software, and systems engineering. In addition, data products and algorithms are being developed by the Navy. STDC and its industry partners will provide the commercial satellite bus, launch services, commercial processing facilities, and long-term flight operations. The NEMO program is currently in the hardware fabrication stage, concentrating on the manufacture and testing of flight hardware. NEMO will carry the Coastal Ocean imaging Spectrometer (COIS) which will provide images of littoral regions with 210 spectral channels over a bandpass of 0.4 to 2.5 micron. Since ocean environments have reflectances typically less than 5% this system requires a very high signal-to-noise ratio (SNR). COIS will sample over a 30 km swath width with

a 60 m Ground Sample Distance (GSD) with the ability to go to a 30 m GSD by utilizing the systems attitude control system to 'nod' (i.e., use ground motion compensation to slow down the ground track of the field of view). Also included in the payload is a co-registered 5 m Panchromatic Imager (PIC) to provide simultaneous high spatial resolution imagery. A sun-synchronous circular orbit of 605 km allows continuous repeat coverage of the whole earth. One unique aspect of NEMO is an on board processing system, a feature extraction and data compression software package developed by NRL called the Optical Real-Time Spectral Identification System (ORASISTM). ORASISTM employs a parallel, adaptive hyperspectral method for real time scene characterization, data reduction, background suppression, and target recognition. The use of ORAS ISTI is essential for management of the massive amounts of data expected from the NEMO Hyperspectral Imagery (HSI) system, and for developing Naval products. The combined HSI and panchromatic images will provide critical phenomenology to aid in the operation of Naval systems in the littoral environment. The imagery can also satisfy a number of commercial and science community requirements for moderate spatial and high spectral resolution remote sensing data over land and water. Specific areas of interest for the Navy include bathymetry, water clarity, bottom type, atmospheric visibility, bioluminescence potential, beach characterization, underwater hazards, total column atmospheric water vapor, and detection and mapping of subvisible cirrus. These data support requirements for Joint Strike and Joint Littoral warfare, particularly for environmental characterization of the littoral ocean. Demonstrations of timely downlinks of near real-time data to the warfighter are also being formulated. The launch date for NEMO has not been set yet. The commercial partner continues to seek necessary commercial capital to complete the program.
Author
Navy; Support Systems; Systems Engineering; Earth Surface; Terrain Analysis; Soil Mapping; Onboard Data Processing; Pattern Recognition; Real Time Operation; Remote Sensing

20010012831 Office National d'Etudes et de Recherches Aerospatiales, High Resolution Imaging Group, Chatillon, France
EARTH OBSERVATION FROM A HIGH ORBIT: PUSHING THE LIMITS WITH SYNTHETIC APERTURE OPTICS
Mugnier, L. M., Office National d'Etudes et de Recherches Aerospatiales, France; Cassaing, F., Office National d'Etudes et de Recherches Aerospatiales, France; Rousset, G., Office National d'Etudes et de Recherches Aerospatiales, France; Sorrente, B., Office National d'Etudes et de Recherches Aerospatiales, France; Space-Based Observation Technology; October 2000, pp. 21-1 - 21-6; In English; See also 20010012824; Copyright Waived; Avail: CASI; A02, Hardcopy

The resolution of a diffraction limited optical telescope is inversely proportional to its diameter; the latter is limited by the current technology to about 10 meters for ground-based systems, and even more limited by volume and mass constraints for space-based systems. Synthetic Aperture Optics (SAO) is a technique that allows the breaking of this limit; it consists in making an array of telescopes (or of mirrors) interfere, so that the data contains some high resolution information at spatial frequencies given by the separation of the telescopes (or 'baseline') rather than by their sizes. In this communication, we first briefly review the two types of SAO instruments (called 'Michelson' and 'Fizeau') and the possible types of beam combination. We then study the possibility of obtaining wide-field interferometric imaging for a Michelson instrument. Then, we address the problem of optimizing the array configuration, which is an important problem for the design of a SAO instrument. We then give some insight on the image restoration, which is a necessary component of the observation system due to the shape of the PSF of a SAO instrument. We conclude that SAO is a promising technique for high resolution Earth observation, especially from a high orbit such as a geostationary one.
Author
Earth Observations (From Space); Imaging Techniques; Synthetic Apertures

20010012832 Alenia Spazio S.p.A., Div. Spazio, Turin, Italy
HIGH RESOLUTION IMAGING FROM THE GEOSTATIONARY ORBIT
Cecconi, Massimo, Alenia Spazio S.p.A., Italy; Cesare, Stefano, Alenia Spazio S.p.A., Italy; Dionisio, Cesare, Alenia Spazio S.p.A., Italy; Space-Based Observation Technology; October 2000, pp. 22-1 - 22-10; In English; See also 20010012824; Original contains color illustrations; Copyright Waived; Avail: CASI; A02, Hardcopy

The geostationary orbit (GEO) is commonly used for telecommunication and meteorological missions, rarely for scientific missions, within certain limit for remote sensing. For this purpose, low orbits (LEO), typically between 500 to 1,000 km in altitude, are employed in order to get higher spatial and radiometric resolutions. However the GEO offers several advantages for the earth observations, which are: possibility of a continuous observations of the same geographic area of interest, coverage of the whole hemisphere and possibility of re-visiting in a short time the same region, real-time dissemination of the data towards the users and constant observation angles. These features are particularly important in the tactical and strategic surveillance. The distance from the Earth (about 36,000 km) represents the main obstacle to the full exploitation of the GEO orbit for the remote sensing. This implies that, to achieve a given spatial resolution and to collect a given photon flux at a given observation wavelength, an instrument with aperture tens of times larger than those employed in LEO must be utilized in GEO. For example, to perform ground observation at very high spatial resolution of about 1 meter in the visible spectral band with a monolithic-mirror telescope, an aperture of about 30-m would be required. With a monolithic-mirror telescope the resolution increase associated to a large aperture is paid first of all in terms of instrument mass. A large primary mirror implies, in addition, the need of the availability of a large volume under the launcher fairing for the accommodation of the instrument. A solution to the problems related to the large aperture, in the cases when the issue is the high resolution and not the light collection (like for the observation of a portion of the Earth surface), is represented by the synthetic aperture technique. It consists in the reconstruction of the original image of an object starting from that formed on the common focal plane of a set of telescopes (or a multi-aperture telescope). To this purpose, the set of telescopes (sub-apertures) must observe simultaneously the object while maintaining constant, within a fraction of wavelengths, the phase of the various wavefronts, which are combined together (so to fulfill the coherence and co-phasing conditions, and to operate consequently like an interferometer). The utilization of an optical system constituted by a set of smaller apertures equivalent for resolution to a single monolithic mirror telescope brings considerably advantages in terms of mass saving and reduction of the storage volume. The scope of this paper is to present concept for a high resolution imaging system, based on the utilization of an optical interferometer and the aperture synthesis technique, for future military surveillance missions from GEO.
Derived from text
High Resolution; Spatial Resolution; Imaging Techniques; Geosynchronous Orbits; Low Earth Orbits; Remote Sensing; Telecommunication; Meteorological Flight

20010012838 Societe Fransaise de Detecteurs Infraouge, Chatenay-Malabry, France
SPACE OBSERVATION AT SOFRADIR
Chatard, Jean-Pierre, Societe Fransaise de Detecteurs Infraouge, France; Vuillermet, Michel, Societe Fransaise de Detecteurs Infraouge, France; Chamonal, Jean-Paul, Nuclear Research Center of Grenoble, France; Space-Based Observation Technology; October 2000, pp. 31-1 - 31-10; In English; See also 20010012824; Original contains color illustration; Copyright Waived; Avail: CASI; A02, Hardcopy

In the frame of space activities, Sofradir has developed a large know-how in the field of infrared detectors. Thanks to some numbers of basic studies, thanks to its participation to the development and manufacturing of the Helios 2 program for which long linear arrays have been produced, Sofradir has established a Mercury Cadmium Telluride technology qualified for space applications. Using MCI technology was a very good choice, not only for the level of performances but also for the flexibility of the material, as it is possible on the same base to manufacture SWIR, MWIR or LWIR detectors. The purpose of the paper is to give some technical information and to present possible evolution of the detectors in regard of space observations.
Author
Space Observations (From Earth); Infrared Detectors

20010012839 Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Inst. fuer Hochfrequenztechnik and Radarsysteme, Wessling, Germany
X-SAR/SRTM PART OF A GLOBAL EARTH MAPPING MISSION
Keydel, Wolfgang, Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; Hounam, David, Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; Pac, Regina, Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; Werner, Marian, Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; Space-Based Observation Technology; October 2000, pp. 32-1 - 32-11; In English; See also 20010012824; Original contains color illustrations; Copyright Waived; Avail: CASI; A03, Hardcopy

X-SAR/SRTM is Germany's and Italy's contribution to the Shuttle Radar Topography Mission (SRTM), which has been operated from February 12th 2000 to February 21st 2000. It is the X-Band radar interferometer. which operated in unison with SIR-C the C-Band interferometer of the US. Both technique and technology of X-SAR/SRTM will be described as well as both the internal and external calibration procedures. The error sources which influence the product quality will be shown as well as first X-SAR results.
Author
Shuttle Imaging Radar; Radar Imagery; Earth Surface; Topography; Soil Mapping; Photomapping

20010012842 Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Inst. of Radio Frequency Technology, Wessling, Germany
PERFORMANCE ANALYSIS FOR THE SRTM-MISSION
Schroeder, Reinhard, Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; Klein, Kay-Bodo, Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; Suess, Helmut, Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; Space-Based Observation Technology; October 2000, pp. 35-1 - 35-5; In English; See also 20010012824; Original contains color illustrations; Copyright Waived; Avail: CASI; A02, Hardcopy

The Shuttle Radar Topography Mission (SRTM) flown on the Shuttle Endeavour from llt' to 22 nd February 2000 has produced the most excellent interferometric image products ever obtained by a spaceborne SAR system. Its final product the global high precision digital elevation map will benefit numerous military and civilian applications. The X-SAR mission operations team included four radar positions for instrument monitoring, performance analysis, contingency handling and radar data analysis. A key step in the acquisition of the high quality radar raw data was the performance analysis of the SAR system. The work presented here considers the major tasks for the X-SAR Performance position in the preparation and the carrying out of the SRTM mission. During the mission the X-SAR Performance position was operated in the Payload Operations Control Center (POCC) of the Johnson Space Center, Houston.
Author
Performance Tests; Performance Prediction; Reliability Analysis; Shuttle Imaging Radar; Radar Imagery

20010012850 Genoa Univ., Dept. of Biophysical and Electronic Engineering, Genoa, Italy
FUSION OF THE MULTI-SENSOR DATA OF THE COSMO-SKYMED MISSION
Melgani, F., Genoa Univ., Italy; Serpico, S. B., Genoa Univ., Italy; Caltagirone, F., Alenia Spazio S.p.A., Italy; Vigliotti, R., Alenia Spazio S.p.A., Italy; Space-Based Observation Technology; October 2000, pp. 52-1 - 52-9; In English; See also 20010012824; Copyright Waived; Avail: CASI; A02, Hardcopy

The COSMO-SkyMed mission will provide remotely-sensed data of the Earth that are very interesting for two main reasons. First, the short revisit time over ground areas, made possible by the constellation of satellites involved, will allow to extract information about the territory or the sea surface on a daily basis. Second, this mission will provide data acquired by sensors of different and complementary nature: SAR, multispectral camera with high spatial resolution (HRC), and hyperspectral camera (HYC). An appropriate signal processing, based on a synergistic use of the data that will be acquired and transmitted to ground stations, will represent a powerful and flexible tool for the investigation of the state of the soil and its changes, and for object detection. Data fusion techniques will be of primary importance in order to exploit the complementary nature of the sensors involved. The purposes may be different, such as a composite display of the information derived from different sensors, target detection, classification, change detection, etc. In this paper, after recalling some basic information about the COSMO-SkyMed mission, a brief survey of the most widespread techniques for the fusion of remote sensing data will be provided. Experimental results obtained with real data will also be presented.
Derived from text
Multisensor Fusion; Imaging Techniques; Image Processing; Signal Processing; Remote Sensing; Multisensor Applications

20010012851 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
THE SHUTTLE RADAR TOPOGRAPHY MISSION
Farr, Tom G., Jet Propulsion Lab., California Inst. of Tech., USA; Kobrick, Mike, Jet Propulsion Lab., California Inst. of Tech., USA; Space-Based Observation Technology; October 2000, pp. 33-1 - 33-3; In English; See also 20010012824; Copyright Waived; Avail: CASI; A01, Hardcopy

On February 22, 2000 Space Shuttle Endeavour landed at Kennedy Space Center, completing the highly successful 11-day flight of the Shuttle Radar Topography Mission (SRTM). Onboard were over 300 high-density tapes containing data for the highest resolution, most complete digital topographic map of Earth ever made. SRTM is a cooperative project between NASA and the National Imagery and Mapping Agency (NIMA) of the U.S. Department of Defense. The mission was designed to use a single-pass radar interferometer to produce a digital elevation model (DEM) of the Earth's land surface between about 60 deg north and 56 deg south latitude. When completed, the DEM will have 30 m pixel spacing and about 15 m vertical accuracy. Two orthorectified image mosaics (one from the ascending passes with illumination from the southeast and one from descending passes with illumination from the southwest) will also be produced.
Derived from text
Shuttle Imaging Radar; Radar Imagery; Topography; Relief Maps; Earth Surface

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ENVIRONMENT POLLUTION

20000047264 North Atlantic Treaty Organization, Special Working Group 12, Brussels, Belgium
SWG/12 MARITIME ENVIRONMENTAL PROTECTION STRATEGY
Koss, Larry, North Atlantic Treaty Organization, Belgium; Alig, Craig S., Naval Surface Warfare Center, USA; Approaches to the Implementation of Environment Pollution Prevention Technologies at Military Bases; April 2000, pp. 1-1 - 1-20; In English; See also 20000047263; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

NATO naval ships operating in the 21st century will be expected to meet increasingly stringent environmental regulations. Special Working Group 12 (SWG/12) has a comprehensive shipboard pollution abatement program under way that will enable ships of the 21st century to be environmentally sound. The goal is for ships to operate worldwide with minimal potential for regulatory constraints, no inappropriate dependence on shore facilities, and no unreasonable costs imposed by environmental regulations. The basic strategy is to: design and operate ships to minimize air emissions, waste generation, and optimize waste management, and, where required, develop shipboard systems that will destroy or appropriately treat the wastes generated on board. If wastes are unavoidable and cannot be destroyed or sufficiently treated so that overboard discharges are not considered environmentally significant, they must be retained on board for recycling or treatment ashore. Although the ultimate solution for on-board destruction has not been achieved for any shipboard wastestream, the members of SWG/12 have made considerable progress toward developing on-board capabilities for managing, treating, or processing solid wastes, oily wastes, hazardous materials, and medical wastes. They are still seeking satisfactory interim or long-term solutions for treating blackwater and graywater, but they have identified technologies with potential to treat these wastes, and development programs are in hand. International cooperative efforts to achieve environmentally sound ships are under way

among NATO navies to share information and technologies, and to save time and money.
Derived from text
Environment Protection; Pollution Control; Waste Management; Ships; Navy

20000047265 Stockholm Environment Inst., Tallinn Centre, Tallinn Estonia
ESTONIAN EXPERIENCES IN APPLICATION OF ENVIRONMENTAL MANAGEMENT
Tammemae, Olavi, Stockholm Environment Inst., Estonia; Approaches to the Implementation of Environment Pollution Prevention Technologies at Military Bases; April 2000, pp. 2-1 - 2-6; In English; See also 20000047263; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

This report describes the development of two important environmental management tools used in Estonia: (1) Environmental Impact Assessment; and (2) Environmental Auditing.
CASI
Environment Management; Estonia

20000047266 Bundesamt fuer Wehrtechnik und Beschaffung, Koblenz, Germany
ENVIRONMENTAL IMPACT ANALYSIS AS A TOOL FOR ENVIRONMENTALLY SOUND DEVELOPMENT
Grunert, Christian, Bundesamt fuer Wehrtechnik und Beschaffung, Germany; Approaches to the Implementation of Environment Pollution Prevention Technologies at Military Bases; April 2000, pp. 3-1 - 3-6; In English; See also 20000047263; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

All human activities cause environmental burdens. The question is whether these burdens are necessary and how great they will be. The amount of environmental impact of a system, either a civil or military one, is defined in the development process. So it is important to take environmental issues into account as early as possible in this process. Environmental issues must be an integral part of every development. The environmental guideline in the procurement process is to develop and to obtain defence materiel that fulfills the military and technical requirements and pollutes the environment as little as possible. For military items, the main emphasis is on operation and disposal during peacetime. The environmental issues during the procurement process can be summarised in the following goals: (1) Saving of energy; (2) preservation of resources; (3) prevention and disposability of waste; (4) reduction of emissions; (5) replacement of hazardous and radioactive materials; (6) preservation of bodies of water; and (7) prevention of soil contamination. These aspects which are very broad will be taken into account during the whole process. Throughout the whole process environmental considerations should be on par with other considerations, such as effectiveness, quality, military life-cycle costs, and terms of delivery.
Derived from text
Environment Management; Procurement; Military Operations

20000047268 Institute for Defense Analyses, Alexandria, VA USA
INFORMATION DISSEMINATION FOR POLLUTION PREVENTION
Brenner, Alfred, Institute for Defense Analyses, USA; Approaches to the Implementation of Environment Pollution Prevention Technologies at Military Bases; April 2000, pp. 5-1 - 5-10; In English; See also 20000047263; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

Pollution prevention for NATO and the Partners for Peace (PfP) nations within the framework of environmental security is a complex and pervasive issue. There are many facets to pollution prevention and reclamation of resources previously polluted by both military and civilian activities. NATO air, land, and sea military operations must take cognizance of these matters without unduly limiting or restricting their efficacy. And new understandings of the matter, changing natural environmental laws, and international agreements are generating a multitude of new approaches to coping with these issues. As the NATO and PfP nations separately and jointly strive to develop processes and introduce new innovative approaches to solve these problems, there will be a large amount of experimental data that can be accumulated and shared. Much leverage may be realized with broad dissemination of the experiences of all the participating nations. The successes in one context or in one nation should be studied for applicability by others. Thus, it is most important to facilitate the timely dissemination of accurate and relevant data and analyses of each country's experiences. Over the last three years, a project for the Committee on the Challenges of Modern Society (CCMS), the Environmental Clearing House System (ECHS), has developed a worldwide electronic data and information exchange system. The ECHS was developed with the understanding that the participants would be geographically widely separated and be serviced with widely different levels of computer capability and knowledge, and communications infrastructure. This system is a good model for methods to effectively disseminate information within the pollution prevention community.
Derived from text
Environment Protection; Data Processing; Information Dissemination; Pollution Control

20000047269 Deutsches Zentrum fuer Luft- und Raumfahrt e.V., Inst. for Physics of the Atmosphere, Oberpfaffenhofen, Germany
IMPACT OF AIRCRAFT EMISSIONS ON THE GLOBAL ATMOSPHERE
Sausen, Robert, Deutsches Zentrum fuer Luft- und Raumfahrt e.V., Germany; Schumann, Ulrich, Deutsches Zentrum fuer Luft- und Raumfahrt e.V., Germany; Approaches to the Implementation of Environment Pollution Prevention Technologies at Military Bases; April 2000, pp. 7-1 - 7-34; In English; See also 20000047263; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

Aviation is a very fast growing economic sector. For instance, in 1998 the number of passengers travelling with Deutsche Lufthansa grew by 9% relative to the previous year. Globally the annual increase rate in air transportation is more than 5%. The rapidly increasing demand for air transport outpaces technological improvements in aircraft and improvements in air traffic management systems: the mean annual increase rate of fuel burn was 2.2% for the years 1985 to 1995. Similar increase rates are expected for the future. Aircraft emit gases (CO2, H2O, NO, SO2, UHC, etc.), aerosols (e.g., soot) and aerosol precursors (e.g., SO3, H2SO4). Hence, aircraft modify the composition of the atmosphere either directly due to these emissions or indirectly via chemical processes, e.g., NO, modifies the ozone concentration. The main concern related with these emissions is the potential for climate change by perturbing the Earth's radiative budget as a result of several processes: (1) the emission of radiatively active substances (e.g. CO2 or H2O); (2) the emission of chemical species which produce or destroy radiatively active substances (like NOx, which modifies the O3 concentration, or SO2, which oxidizes to sulfate aerosols); (3) the emission of substances (e.g. H2O, soot) which trigger the generation of additional clouds (e.g. contrails). Due to the internal variability of the atmosphere, it is extremely difficult to detect the climatic impact of a single economic sector in climate observations or in simulations with comprehensive climate models. Therefore we consider the radiative forcing (RF) associated with various perturbations of the atmospheric composition. RF is known to be a good predictor of global climate change in terms of variables like the global mean surface temperature change or mean sea level rise. On average the global mean surface temperature increases by 0.6 K per 1 Wm(exp -2) of RF. In the following we consider various individual contributions to the radiative forcing and concentrate on 1992 and 2050. While the current and past emissions of aviation are reasonably well known, we have no reliable forecasts of the future. Hence, we make use of emission scenarios, which have been developed for various economic and technological assumptions. We study in greater detail the aviation scenario Fa1 that makes similar economic assumptions as the IPCC scenario IS92a for all anthropogenic emissions. In the latter scenario the CO2 concentration increases by 0.6% annually. The aviation scenario Fa1 assumes a mean annual increase rate of 1.7% for the fuel burn until 2050.
Derived from text
Exhaust Gases; Exhaust Emission; Atmospheric Composition; Climate Change; Air Transportation; Radiative Transfer

20000047270 Ministry of Defence, London, UK
UK MINISTRY OF DEFENCE USE OF OZONE DEPLETING SUBSTANCES: IMPLICATIONS OF THE NEW EUROPEAN COUNCIL REGULATION
Liddy, D. J., Ministry of Defence, UK; Approaches to the Implementation of Environment Pollution Prevention Technologies at Military Bases; April 2000, pp. 8-1 - 8-6; In English; See also 20000047263;

The Montreal Protocol controls the production of the ozone depleting substances. These have been used extensively in fire protection and refrigeration in military equipment and systems. The implications of the Protocol for the military forces of NATO states were covered in LTSS/44, and the worthy conclusions and recommendations were reported in the opening sessions of the Symposium. The current legislative position on ozone depleting substances within the European Union is described. The policies that the UK Ministry of Defence has in place, and the progress that has been made, so far, in reducing use of the substances is discussed. Of course, legislation continually evolves, so the recent developments in the European Union, finally suggesting that NATO could, perhaps, play a valuable, more proactive, part in the development of new international environmental legislation is summarized.
Derived from text
Environment Protection; International Law; Ozone Depletion; Air Pollution; Refrigerants; Chlorofluorocarbons

20000047272 Ministry of Environmental Protection and Regional Development, Riga, Latvia
SITE CONTAMINATION PROBLEMS IN THE REPUBLIC OF LATVIA: ONGOING CLEAN-UP ACTIVITIES AND FUTURE POLLUTION PREVENTION PLANS
Strauss, Ilgonis, Ministry of Environmental Protection and Regional Development, Latvia; Semyoniv, Ivan, Ministry of Environmental Protection and Regional Development, Latvia; Blumberga, Una, Ministry of Environmental Protection and Regional Development, Latvia; Approaches to the Implementation of Environment Pollution Prevention Technologies at Military Bases; April 2000, pp. 10-1 - 10-8; In English; See also 20000047263;

Today the problem of site pollution in the Republic of Latvia is becoming more and more important not only as an environmental problem, but also as one, which hinders the growth of economics because it creates difficulties for investments. In the Environmental Policy Plan of Latvia, officially approved in 1995, the site pollution problem was not identified as the first priority. At that period such issues as drinking water supply & wastewater treatment, waste management and air pollution problems were considered as more urgent. Presently situation has changed and site contamination problem is one of those which needs be solved within the near future.
Derived from text
Environment Management; Military Operations; Latvia; Environmental Cleanup; Decontamination

20000047273 Department of National Defence, Ottawa, Ontario Canada
POLLUTION PREVENTION IN THE LAND MAINTENANCE SYSTEM
Beshai, Joan, Department of National Defence, Canada; Berthiaume, Holmer, Department of National Defence, Canada; Approaches to the Implementation of Environment Pollution Prevention Technologies at Military Bases; April 2000, pp. 11-1 - 11-6; In English; See also 20000047263;

This paper presents the implementation plan for the Sustainable Development Strategy in maintenance workshops serving the Canadian Land Forces. Workshop surveys were conducted during which opportunities for pollution prevention and impediments to positive changes were identified. Reducing sources of pollution was the primary goal but reducing costs and improving working conditions were also considered. This initiative will reduce the amount of hazardous materials used and the amount of spent material, which must be disposed of as hazardous waste. Existing equipment is being audited and the requirement for use of high-risk consumables is being reviewed to eliminate or reduce their use. A material substitution program has made progress in lessening the dependence on high-risk products. The paper also discusses progress in developing and integrating the building blocks of an information system designed to track the consumption of hazardous materials and the generation of waste, to identify products containing targeted substances and to evaluate the relative hazards of products required to operate and maintain equipment.
Author
Hazardous Materials; Pollution Control; Canada; Environment Pollution; Environmental Cleanup

20000047274 Vilnius Gediminas Technical Univ., Vilnius, Lithuania
STRATEGY OF MILITARY LANDS REUSING IN LITHUANIA
Baltrenas, P., Vilnius Gediminas Technical Univ., Lithuania; Ignatavicius, G., Vilnius Gediminas Technical Univ., Lithuania; Approaches to the Implementation of Environment Pollution Prevention Technologies at Military Bases; April 2000, pp. 12-1 - 12-8; In English; See also 20000047263;

The Soviet army left Lithuania in 1993. Upon withdrawal they have left about 500 various military installations. There were 277 Soviet military bases in which 462 military units were located at that time. Sizes of military sites varied in a rather wide scale - from less then 100 sq m (workshops) to nearly 14000 ha (forestry). Military sites according to their sizes are presented. All military sites occupied territories of 67762 ha, which make 1.04% of Lithuania's territory. Currently, 16.7% of the territory has been left to satisfy the Lithuanian military needs and the rest has been transferred to civil users.
Derived from text
Lithuania; Military Operations; Land Management; Environment Management

20000047275 Ministry of Defence of the Czech Republic, Olomouc, Czech Republic
SOCIO-POLITICAL TOOLS IN THE IMPLEMENTATION OF ENVIRONMENTAL POLLUTION PREVENTION AT MILITARY BASES
Kozl, Petr, Ministry of Defence of the Czech Republic, Czech Republic; Approaches to the Implementation of Environment Pollution Prevention Technologies at Military Bases; April 2000, pp. 13-1 - 13-4; In English; See also 20000047263;

Our technical society is often forgetting about a human role. However, the human role is still very important to function of a technical and technological systems. Not only the technologies but also socio-political tools are also necessary to the implementation of environmental pollution prevention at military bases.
Author
Environment Pollution; Environment Protection; Military Operations

20000047279 Academy of Sciences of the Georgian SSR, Tbilisi, Georgia
REMEDIAL PROPOSALS FOR FORMER MILITARY LANDS IN GEORGIA
Zakariadze, Nino, Academy of Sciences of the Georgian SSR, Georgia; Approaches to the Implementation of Environment Pollution Prevention Technologies at Military Bases; April 2000, pp. 17-1 - 17-4; In English; See also 20000047263;

The state of the environment in Georgia is influenced clearly by political and economic situation of the recent several years and the consequences of it are the pollution and disorder of natural equilibrium in different regions to a great extent. The survey concerning the state of former military regions in our country is an initial attempt for the solution of one of the specific issues of this global problem. After withdrawal of former Soviet Troops from the territory of Georgia and transmission of their former military bases to Georgian Government, in already heavily polluted country new problems have emerged. The question is the toxic and explosive substances, harmful waste, most of which is unfit and is not liable to utilisation. For example, near the coast of Black Sea, and in Eastern Georgia as well, more than thousand tons of liquid rocket fuel components as 'Melange' and 'Simine' are distributed without control, which creates significant risk for the population and environment. Some cases of their spilling without neutralisation into the Black Sea, leakage in soil and even explosion are observed. The reservoirs of the fuel are located near to Soganlugi, Meria, Chaladidi regions and Supsa pipeline construction. Part of them is deformed and part of them damaged. Because of expiration, the pressure in some of them has dangerously increased. According to former Soviet Army instructions 'Melange' was neutralised with the water solution of caustic sodium and 'Simine' with solution of bohr acid and after mixing with kerosene were burnt. The technological scheme is hardly acceptable from the environmental point of view. The new schemes for rendering harmless these substances are suggested which inevitably need special scientific processing. Increase of radioactive background is observed in various regions of former Military Troops (Vaziani, Lilo,

Abastumani, Senaki, Telavi, Poti, Kutaisi, Kopitnari). The radiation is caused by parts of damaged radiometric equipment with the source of radiation, which are distributed without control from rubbish heaps even to apartments and yards of the habitants. Concerning this problem on October 9, 1997, by the order of President of Georgia the special Governmental Commission was established, whose objective is to study chemical and radioactive pollution in the territories transmitted to Georgian Governmental structures by the Soviet troops. Because of deficiency of means and special equipment the commission has to work in extremely hard conditions. That influences a quality of work and increases hazards and disaster likelihood. By the members of this commission in collaboration with representatives of International Agency of Nuclear Energy, the area for temporary storage of radioactive waste has been chosen, which has to meet the international norms and will be in action after completing of corresponding work. Again the lack of finances creates constrains. One of the main reasons of these events is incomplete special form of the document concerning territory transmission, from one side to another and the absence of a specific law on the issue. The Laws of Georgia on Environmental Permit and on State Environmental Assessment do not contain specific articles for creating necessary documents and delineating responsibilities for each side. Apart from the Ministry of Environment and Natural Resources Protection, there are more than hundred environmental NGO's in Georgia. But in spite of this number, co-ordinated and purposeful work in this field is not carried out. Due to this situation the group of Georgian scientists from Institutes of Geophysics, Physiology, Academy of Science supported by Ministry of Defense, Parliamentary Security Committee and the Department of Political-Military Affairs of Georgia express the willingness to conduct the special research and field works.
Derived from text
Environment Protection; Georgia (Eurasia); Radiation Hazards; Toxic Hazards; Waste Disposal; Hazardous Wastes; Environmental Cleanup

20000047281 Military Univ. of the Ground Forces, Czech Republic
WASTE MANAGEMENT COMPLIANCE IN THE ARMY OF THE CZECH REPUBLIC
Komar, Ales, Military Univ. of the Ground Forces, Czech Republic; Bozek, Frantizek, Military Univ. of the Ground Forces, Czech Republic; Dvorak, Jiri, Military Univ. of the Ground Forces, Czech Republic; Hoza, Ignac, Military Univ. of the Ground Forces, Czech Republic; Approaches to the Implementation of Environment Pollution Prevention Technologies at Military Bases; April 2000, pp. 19-1 - 19-6; In English; See also 20000047263; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

The key area in providing environmental safety is the issue of effective management of waste being created during the daily life and training of troops. Law No 125/1987 concerning wastes, which came into existence last year, is the fundamental regulation in the Czech Republic. The law determines the liabilities in wastes disposal and prevention of their origin and it modifies supervision by state authorities and their decision-making process. It fully applies to the military sector with only one specific enactment - records of wastes produced by the Ministry of Defence are processed and kept by this Ministry in cooperation with the Ministry of Environment.
Author
Waste Management; Czech Republic; Environment Management

20000047282 Norwegian Defence Construction Service, Oslo, Norway
HAAKONSVERN NAVAL BASE, BERGEN-NORWAY POLLUTION PREVENTION OF PCB-CONTAMINATION IN SEA SEDIMENTS
Morch, Torgeir, Norwegian Defence Construction Service, Norway; Laugesen, Jens, Det Norske Veritas, Norway; Approaches to the Implementation of Environment Pollution Prevention Technologies at Military Bases; April 2000, pp. 20-1 - 20-4; In English; See also 20000047263; Copyright Waived; Avail: CASI; A01, Hardcopy; A03, Microfiche

In this paper the prevention of PCB-contamination in sea sediments at the Haakonsvern Naval Base in Bergen, Norway is discussed.
Author
Norway; Pollution Control; Polychlorinated Biphenyls; Environment Management

20000047283 Federal Ministry for the Environment, Nature Conservation and Nuclear Safety, Berlin, Germany
THE CLEAN-UP OF CONTAMINATED MILITARY SITES, CONSEQUENCES FOR A POLLUTION PREVENTION APPROACH, REQUIREMENTS FROM A VIEWPOINT OF ENVIRONMENTAL PROTECTION
Szelinski, B. A., Federal Ministry for the Environment, Germany; Approaches to the Implementation of Environment Pollution Prevention Technologies at Military Bases; April 2000, pp. 22-1 - 22-8; In English; See also 20000047263; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

This seminar is held as a follow up of the NATO Study on 'Environmental Technologies' which was concluded in September 1996. The focus of this study was to get a better understanding of contamination from military sources, to identify existing or evolving technologies and strategies to minimize environmental impacts of military operations and its areas for potential application in the military, and to identify research and development activities which may be required in the future. The study was focused on the following substances: Petroleum, Oil and Lubricants (POLs), Munitions, Energetics, and Propellants, Ozone Depleting Substances (ODS), Fire Suppressants and Refrigerants, Volatile Organic Compounds (VOCs), Solvents and Surface Cleaners, Inorganic Surface Coatings, Organic Surface Coatings, Shipboard Liquid Waste, Shipboard Solid Waste, and Pesticides. The military and the environment is a fascinating issue, since this is almost the only field in modern societies, where there is a certain prerogative when it comes to environmental protection, to environmental information and to environmental action. Additionally the military loves to have an aura of secrecy around what it does and, there are rumors also around what it does not do. It is encouraging to see that there is a growing concern about the environmental impacts of peacetime military operations. And the whole setting of this study is fascinating, since it produces a deja vue feeling at least for people who look at it from a view point of environmental administrations.
Derived from text
Environment Protection; Military Operations; Pollution Control; Contamination; Environmental Cleanup

20000047285 Defence Evaluation Research Agency, Mechanical Sciences Sector, Farnborough, UK
THE UK MOD APPROACH TO THE REDUCTION OF VOC'S AT SERVICE BASES
Higgs, M. S., Defence Evaluation Research Agency, UK; Hitchen, C. J., Defence Evaluation Research Agency, UK; Patel, J., Defence Evaluation Research Agency, UK; Approaches to the Implementation of Environment Pollution Prevention Technologies at Military Bases; April 2000, pp. 24-1 - 24-10; In English; See also 20000047263; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

Environmental legislation has forced the Royal Air Force, Army and Royal Navy to perform a critical and comprehensive review of both the processes they undertake and the types of materials they use. The paints and coatings world, in particular, faces many challenges and the UK MOD as a significant user of paints and paint removers has to address the problems associated with meeting environmental pressures whilst retaining existing performance criteria. This paper will outline the legislation contained within the Environmental Protection Act (EPA) which has been introduced to control the atmospheric discharge of volatile organic compounds (VOCs) and will highlight the consequent implications to the UK MOD. The alternative technical solutions to ensure compliance with the legal requirements including 'Compliant Coatings' will be discussed. Although the UK MOD faces many challenges within the painting and paint removal field, this paper will concentrate on the refinishing of military vehicles and aircraft and associated processes. These are priority areas, as this process involves a significant consumption of paint materials and, therefore, high volumes of VOC. Work undertaken to introduce compliant coatings as alternatives to traditional solvent based products is detailed and the programme highlights the effective co-operation between the Defence Evaluation & Research Agency (DERA), Army and Royal Air Force Departments and the Directorate of Standardisation. The approach by these departments to reduce the consumption of VOC's from supplementary processes to painting are also outlined. In addition, a brief review of the approach adopted by the Royal Navy will be discussed. As part of the process the various phases of the project will be

discussed. This covers the definition of MOD requirements, which can be unique to the Defence arena. It will review laboratory based performance testing, user trials of the materials and the development of the materials specification concluding with the production of Standards for the materials.
Author
Environment Protection; Organic Compounds; Military Operations; Pollution Control

20000047287 Military Univ. of Technology, Warsaw, Poland
INVESTIGATIONS INTO RISK ASSESSMENT AND COST ANALYSIS AS TOOLS FOR POLLUTION PREVENTION DURING MILITARY EXERCISES AND TRAINING
Neffe, Slawomir, Military Univ. of Technology, Poland; Malecki, Mark, Ministry of National Defence, Poland; Approaches to the Implementation of Environment Pollution Prevention Technologies at Military Bases; April 2000, pp. 27-1 - 27-8; In English; See also 20000047263; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

Military forces are big and diverse organisation with heavy demands for equipment, chemicals and other materials when conducting training, exercises and day to day missions. Military forces are also producers of large quantity of hazardous and harmful wastes, which in the field conditions can have strong negative influence on the environment. Many of these wastes are similar to those of large civilian industrial organisations, but some are peculiar to the army mission. The main purpose of the presentation is to show ideas developed for estimation of environmental losses and costs resulting from military exercises and training activities of land troops, navy and airforce. The legislative, economic and technical tools, which lead to the minimization of the environmental damages during the military training and exercises, are discussed. Types of military training activities and materials, which have the most severe environmental impact, have been identified. Furthermore, the paper describes measures undertaken within the military sector to face the environmental standards and regulations relating to national guidelines on air, water, soil, and nature protection during the military training and exercises.
Author
Assessments; Cost Analysis; Hazardous Wastes; Pollution Control; Risk

51
LIFE SCIENCES (GENERAL)

20000033303 Research and Technology Organization, Human Factors and Medicine, Neuilly-sur-Seine, France
INDIVIDUAL DIFFERENCES IN THE ADAPTABILITY TO IRREGULAR REST-WORK RHYTHMS/STATUS OF THE USE OF DRUGS IN SLEEP-WAKEFULNESS MANAGEMENT *[LES DIFFERENCES ENTRE INDIVIDUS CONCERNANT LES FACULTES D'ADAPTATION AUX RYTHMES IRREGULIERS ACTIVITE-REPOS/LE POINT SUR L'UTILISATION DES MEDICAMENTS POUR LA GESTION DES PERIODES VEILLE-SOMMEIL]*
Individual Differences in the Adaptability to Irregular Rest-Work Rhythms/Status of the Use of Drugs in Sleep-Wakefullness Management; March 2000; 171p; In English; 3-4 Jun. 1999, Venice, Italy; See also 20000033304 through 20000033323
Report No.(s): RTO-MP-31; AC/323(HFM)TP/11; ISBN 92-837-1031-2; Copyright Waived; Avail: CASI; A08, Hardcopy; A02, Microfiche; C01, CD-ROM

This Lecture Series evaluates the human factors implications for pilots of 'superagile flight', specifically with regard to agile airframes, agile weapons, and rapidly configurable systems. During interviews, experienced pilots have confirmed the operational need for military aircraft agility. Although pilots have noted that their experiences to date have not caused them any major concerns regarding the potential for physiological problems, significant gaps remain in our understanding of the effects of multi-axis accelerations. Human consequences are also anticipated in the area of situational awareness. Presentation of aircraft attitude and energy state in a helmet mounted display will be a design challenge. The minimal constraints on aircraft incidence angles and the expanded weapon launch envelopes anticipated with the forthcoming and next generations of air systems requires the provision of novel displays to enable pilots to effectively operate such air systems. Decision aids, intelligent interfaces and automated subsystems are required to enable pilots to maintain situational awareness whilst coping with dramatic increases in the tempo of the tactical situation and the 'data deluge'. Moreover, many of the current pilot protection systems will be inadequate for everyday use in such an unconstrained flight envelope and during ejection. Additional challenges in selection, simulation, and training are also anticipated
Author
Human Factors Engineering; Decision Support Systems; Drugs; Sleep; Rhythm (Biology)

20000098510 Research and Technology Organization, Human Factors and Medicine, Neuilly-sur-Seine, France
OFFICER SELECTION *[LA SELECTION DES OFFICIERS]*
Officer Selection; August 2000; 232p; In English; 9-11 Nov. 1999, Monterey, CA, USA; See also 20000098511 through 20000098541; CD-ROM contains full text document in PDF format
Report No.(s): RTO-MP-55; AC/323(HFM)TP/27; ISBN 92-837-0016-3; Copyright Waived; Avail: CASI; A11, Hardcopy; A03, Microfiche; C01, CD-ROM

The Human Factors and Medicine (HFM) Panel held a workshop on 'Officer Selection' at the Hilton Hotel in Monterey, California, USA, 9th - 11th November 1999. The theme of this workshop, officer selection, is an issue of central importance to the military forces of all countries, since it determines which individuals, with what characteristics, will be available to lead the forces in the future. Thirty-three workshop papers were presented by representatives from: Austria, Belgium, Canada, the Czech Republic, Denmark, France, Germany, Italy, The Netherlands, Poland, Singapore, Sweden, Switzerland, Turkey, Ukraine, the UK, and the USA. The workshop provided an opportunity for cross-fertilization of ideas between military and civilian personnel managers and researchers across many professional disciplines.
Author
Personnel Selection; Armed Forces; Personnel Management

20000105060 Research and Technology Organization, Human Factors and Medicine Panel, Neuilly-sur-Seine, France
OPERATIONAL ISSUES OF AGING CREWMEMBERS *[LES CONSEQUENCES OPERATIONNELLES DU VIEILLISSEMENT DES EQUIPAGES]*
Operational Issues of Aging Crewmembers; August 2000; 275p; In English; In French; 33rd; 11-14 Oct. 1999, Toulon,, France; See also 20000105061 through 20000105089; CD-ROM contains full text document in PDF format
Report No.(s): RTO-MP-33; AC/323(HFM)TP/13; ISBN 92-837-0015-5; Copyright Waived; Avail: CASI; A12, Hardcopy; A03, Microfiche; C01, CD-ROM

The Human Factors and Medicine (HFM) Panel held a Symposium on 'Operational Issues of Aging Crewmembers' in Toulon, France, from 11 to 14 October 1999. In many NATO countries, the populations in general are aging and military crewmembers are an increasingly older population. In downsizing militaries with scarce resources, the increasing costs of training and the significant experience (also at significant cost) of aging crewmembers make them an increasingly valued commodity, particularly as projected in the militaries of the future. Experience, wisdom, healthy lifestyles, and medical and technological advances seem to compensate to some extent for decreased performance and other adverse effects of aging (physical, physiological and psychological) in many crewmembers. Most 'aging' studies have accumulated data on general civilian populations and data on the performance of aging crewmembers in military environments have not been previously summarized and presented on any large scale. Thus, the NATO HFM Symposium on 'Operational Issues of Aging Crewmembers' was planned to present available data regarding whether or not healthy lifestyles, technological advances and compensatory factors of aging crewmembers, such as experience, adequately compensate for performance among various types of aging crewmembers (pilots, special crew, divers, etc.). If so, a re-evaluation of age policies for military crewmembers might be justified. The Symposium was divided into 3 sessions to accommodate the various topics related to aging crewmembers working in various stressful military environments. In the Session 'Operational Aspects of Aging Crewmembers', papers were presented on G tolerance, jet lag, spinal disease, ECG findings during centrifuge training, hypoxia tolerance and time of useful

consciousness during hypobaric flights, and pulmonary function in divers. In the Session on 'Aging Crewmembers: Psychological and Cognitive Performance Implications', there were presentations on sleep, wording memory, personality, behavior, fatigue, risk taking, safety and mission completion, psychological performance, cognitive and sensory limitations and neuropsychiatric referrals. During the final Session, on 'Physiological and Sensory Aspects of Aging', papers were presented on anthrax immunization, growth hormone, endocrine responses to training programs, autonomic cardiovascular control, biochemical-metabolic indices, endothelial dysfunction, intima media thickness, cardiovascular risk factors, visual acuity, ocular problems, intraocular lenses, visual performance during small letter contrast tests and on modern cockpits.
Derived from text
Conferences; Aging (Biology); Age Factor; Research

20010032429 Research and Technology Organization, Human Factors and Medicine Panel, Neuilly-sur-Seine, France
THE EFFECT OF PROLONGED MILITARY ACTIVITIES IN MAN. PHYSIOLOGICAL AND BIOCHEMICAL CHANGES. POSSIBLE MEANS OF RAPID RECUPERATION ***[LES EFFETS D'ACTIVITES MILITAIRES PROLONGEES SUR L'HOMME. CHANGEMENTS PHYSIOLOGIQUES ET BIOCHIMIQUES. MOYENS POSSIBLES DE RECUPERATION RAPIDE]***
March 2001; 134p; In English; 3-5 Apr. 1995, Oslo, Norway; See also 20010032430 through 20010032439; CD-ROM contains full text document in PDF format; Compatible with MAC and IBM platforms
Report No.(s): RTO-MP-042; AC/323(HFM)TP/23; ISBN 92-837-1054-1; Copyright Waived; Avail: CASI; A07, Hardcopy; A02, Microfiche; C01, CD-ROM

New technology and operational concepts have provided new challenges to military personnel#s health, safety and performance. These proceedings include ten papers, dealing with different aspects of the biomedical consequences of continuous military operations. They were presented at a workshop organized by the former DRG of NATO in Soria Moria, Oslo, Norway, 3-5 April 1995, and this publication has been sponsored by the Human Factors and Medicine Panel (HFM) of RTO. The papers show large alterations in hormones, metabolites, red and white blood cells, as well as mental performance. There was an adrenergic desensitization, decrease in thyroid function due to energy deficiency, and decrease in androgens due to physical exercise. Unspecific immune function (granulocytes and monocytes) were stimulated, while specific immune function (lymphocytes) were inhibited. Acute sleep deprivation mainly affects mental functions and have limited influence on endocrine, metabolic and immune functions. The key questions addressed by the workshop were how to select and train personnel for continuous operations, and how to intervene to enhance physical and mental performance by such means as nutrition, sleep, work-rest schedules and drugs. The optimal treatment for soldiers# recovery and reentry to the battlefield following high intensity direct action missions was also discussed. The participants agreed that there is a need for more realistic field studies with systematic interventions with different stress factors to reveal their relative significance and to find counter measures.
Author
Biochemistry; Desensitizing; Drugs; Health; Human Factors Engineering; Mental Performance; Personnel; Physical Exercise; Procedures

20010076799 Research and Technology Organization, Human Factors and Medicine Panel, Neuilly-sur-Seine, France
OPERATIONAL MEDICAL ISSUES IN HYPO- AND HYPERBARIC CONDITIONS ***[LES QUESTIONS MEDICALES A CARACTERE OPERATIONNEL LIEES AUX CONDITIONS HYPOBARES OU HYPERBARES]***
Operational Medical Issues in Hypo- and Hyperbaric Conditions; June 2001; 382p; In English; In French; 16-19 Oct. 2000, Toronto, Canada; See also 20010076800 through 20010076846; CD-ROM contains full text document in PDF format; Original contains color illustrations
Report No.(s): RTO-MP-062; AC/323(HFM-050)TP/34; ISBN 92-837-0019-8; Copyright Waived; Avail: CASI; C01, CD-ROM; A17, Hardcopy; A03, Microfiche

On 16-19 October 2000, NATO, Partnership for Peace (PfP), and Non-NATO nationals from 24 countries met in Toronto, Canada to attend a symposium on Operational Medical Issues in Hypo- and Hyperbaric Conditions relevant to the alliance, arranged by NATO/RTO/HFM. Exposures to the said conditions are experienced regularly in military operations, but this was the first time operational medical issues affecting air, sea, and land forces were addressed in a NATO forum. Canada was chosen as venue site due to Canadian research establishments' expertise in special environmental issues. Themes addressed were decompression illness, breathing gas composition, hypoxia, hyperbaric oxygen treatment of combat injuries, selection, training and adaptation of personnel for special operations, Eustachian tube function, barotrauma, alternobaric vertigo, positive pressure breathing and long term health damage in divers. Relevant technical issues were also discussed.
Author
Decompression Sickness; Diving (Underwater); Hypoxia; Pressure Breathing; Hyperbaric Chambers; Hypobaric Atmospheres; Aerospace Medicine

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AEROSPACE MEDICINE

19990021564 Research and Technology Organization, Human Factors and Medicine Panel, Neuilly-sur-Seine, France
CERVICAL SPINAL INJURY FROM REPEATED EXPOSURES TO SUSTAINED ACCELERATION ***[LES TRAUMATISMES DE LA COLONNE CERVICALE DUS AUX ACCELERATIONS SOUTENUES ET REPETITIVES]***
February 1999; 104p; In English
Report No.(s): RTO-TR-4; AC/323(HFM)TP/9; ISBN 92-837-1013-4; Copyright Waived; Avail: CASI; A06, Hardcopy; A02, Microfiche

Published articles and reports on current studies by several nations on cervical neck injury, spinal degeneration and related topics are reviewed and analyzed in detail in the first 11 chapters. In Chapter 12 the biomechanics of the cervical spine and predictive models on cervical injury from sustained G exposures are presented. Meta-analysis of 8 control-studies on the direct effects of sustained G exposures on cervical degeneration was performed and presented in Chapter 13. The statistical probability of a causal relationship was determined to be P less than 0.001. In Chapter 14, this information was summarized and further developed into a model on the relationship between aging and sustained G exposures on cervical spinal degeneration. In this model, cervical spinal degeneration occurs with repeated exposures to sustained G and with aging. However because of the continuous and pervasive effects of aging, the pilot population and non-G exposed population (controls) are predicted to have the same levels of cervical degeneration later in life. Recommendations presented in the last chapter include the need for more research on this topic, the development of standardized nomenclature and databases, and specific considerations on the prevention and treatment of acute neck injuries.
Author
Back Injuries; Spine; Spinal Cord; Acceleration Tolerance; Human Tolerances; Neck (Anatomy); Biodynamics; Acceleration Stresses (Physiology)

19990068480 Research and Technology Organization, Human Factors and Medicine Panel, Neuilly-sur-Seine, France
AEROMEDICAL ASPECTS OF AIRCREW TRAINING ***[LES ASPECTS AEROMEDICAUX DE LA FORMATION DES EQUIPAGES]***
June 1999; 96p; In English; 14-18 Oct. 1998, San Diego, CA, USA; See also 19990068481 through 19990068496
Report No.(s): RTO-MP-21; AC/323(HFM)TP/8; ISBN 92-837-1016-9; Copyright Waived; Avail: CASI; A05, Hardcopy; A01, Microfiche

A RTO Human Factors and Medicine Panel Workshop held in San Diego, California, in October 1998 brought together Aeromedical Trainers to discuss current Aeromedical Training Programs and to present new approaches to this training. Various approaches to Aeromedical Training were also discussed and STANAG 3114 'Aeromedical Training of Flight Personnel' was reviewed. Presentations included: categories of training, subjects taught, frequency of training, duration of courses, period of validity and altitude chamber profiles utilized. Most NATO countries were present and provided overviews of their programs, as did representatives from Poland and the Czech Republic. Presentations also included new approaches to

Aeromedical Training including: Simulator Based Physiology Training (SYMPHYS), Simulator Based Disorientation Training and In-Flight Disorientation Training. The Workshop recommended changes to STANAG 3114 including, but not limited to: removal of the split between Rotary and Fixed-wing aircraft training requirements, addition of the requirement for instruction on aeromedical aspects of new Life Support Equipment and addition of the requirement for a practical Spatial Disorientation experience during refresher training. Also recommended was the establishment of a Working Group to study the variation between countries in rates of Decompression Illness from altitude chamber exposure. It was also recommended that NATO validate the need for a new STANAG on Night Vision Training.
Author
Aerospace Medicine; Human Factors Engineering; Training Devices; Training Simulators; Flight Training; Flight Simulation; Altitude Simulation; Flight Crews

19990068481 Royal Air Force, Aviation Training Centre, Henlow, UK
AVIATION MEDICINE TRAINING OF ROYAL AIR FORCE AIRCREW
Morris, C. B., Royal Air Force, UK; Aeromedical Aspects of Aircrew Training; June 1999, pp. 1-1 - 1-7; In English; See also 19990068480; Copyright Waived; Avail: CASI; A02, Hardcopy; A01, Microfiche

This paper opens with a brief history of aviation medicine training in the Royal Air Force (RAF). The details of courses currently run by the RAF Aviation Medicine Training Centre (AMTC) are included together with information about the practical content of each course. In addition, the paper includes specific details of hypobaric chamber profiles used at AMTC and covers the possible reasons behind the lack of decompression sickness incidents experienced by the RAF. The paper closes with an explanation of the internal audit procedure employed at AMTC.
Author
Aerospace Medicine; Flight Crews; Crew Procedures (Inflight); Education; Training Analysis; Pilot Training; Classes

19990068482 Royal Air Force, Aviation Medicine Training Centre, Henlow, UK
SPATIAL DISORIENTATION TRAINING OF ROYAL AIR FORCE AIRCREW
Daulby, D. J., Royal Air Force, UK; Aeromedical Aspects of Aircrew Training; June 1999, pp. 2-1 - 2-2; In English; See also 19990068480; Copyright Waived; Avail: CASI; A01, Hardcopy; A01, Microfiche

This paper gives the rationale behind the spatial disorientation training given to Royal Air Force (RAF) aircrew at the RAF Aviation Medicine Training Centre at Henlow. The link between aircrew roles, their experience levels and the training provided is explained and the content of the lecture program is covered. Details of the practical training aircrews receive is included and the way the training is matched to individual requirements is explained. The paper ends with a brief look at the future of disorientation training within the RAF.
Author
Aerospace Medicine; Flight Crews; Education; Training Analysis

20000011735 Research and Technology Organization, Human Factors and Medicine Panel, Neuilly-sur-Seine, France
CURRENT AEROMEDICAL ISSUES IN ROTARY WING OPERATIONS *[PROBLEMES ACTUELS DE MEDECINE AERONAUTIQUE POSES PAR LES OPERATIONS UTILISANT DES VOILURES TOURNANTES]*
Current Aeromedical Issues in Rotary Wing Operations; August 1999; 356p; In English; 19-21 Oct. 1998, San Diego, CA, USA; See also 20000011736 through 20000011776; Original contains color illustrations
Report No.(s): RTO-MP-19; AC/323(HFM)TP/4; ISBN 92-837-0008-2; Copyright Waived; Avail: CASI; A16, Hardcopy; A03, Microfiche

These proceedings include the Technical Evaluation Report, Keynote Address, and 41 papers from the Symposium sponsored by the NATO/RTO Human Factors and Medicine Panel, which was held in San Diego, California, USA from 19-21 October 1998. Rotary wing operations include military or civilian missions such as transport, medevac, and combat. A range of human factors problems may be implicated in helicopter mishaps, such as spatial disorientation or excessive workload. Furthermore, flying a helicopter can contribute to various specific pathologies, ranging from lower back pain to flight phobias. In several helicopter accidents, it has been suggested that injuries could have been avoided if adequate safety and protection technologies had been used. Although helicopters can be used for medevac involving large numbers of wounded, the use of helicopters has to be fully integrated with other transport systems and their equipment should be adapted for this type of mission. New training methods, such as crew resource management or spatial disorientation training, and new technologies, such as the 'tactile situation awareness system' (TSASI) may, when fully implemented, help to avoid accidents. Utilization of swimming pools with specific tools for helicopter evacuation training can greatly reduce the risk of death by immersion. On the other hand, more effort is needed to improve the personal flight equipment. Although epidemiological data suggest that the risk of accidents and injuries is already low in certain air forces, the introduction of new protection technologies may help to further reduce the numbers of wounded. This symposium provided a review, of the state-of-the-art concerning the various human factors implicated in helicopter operations, new methods and systems for increasing safety and efficiency of the helicopter operations, and new methods and systems for increasing safety and efficiency of the helicopter crew.
Author
Aerospace Medicine; Human Factors Engineering; Rotary Wing Aircraft; North Atlantic Treaty Organization (NATO); Resources Management; Conferences; Psychological Effects

20000011753 Centro de Instruccion de Medicina Aeroespatial, Madrid, Spain
LOW BACK PAIN IN HELICOPTER PILOTS
Vallejo, P., Centro de Instruccion de Medicina Aeroespatial, Spain; Lopez, J., Centro de Instruccion de Medicina Aeroespatial, Spain; Rios-Tejada, F., Centro de Instruccion de Medicina Aeroespatial, Spain; Azofra, J., Centro de Instruccion de Medicina Aeroespatial, Spain; DelValle, J., Centro de Instruccion de Medicina Aeroespatial, Spain; Velasco, C., Centro de Instruccion de Medicina Aeroespatial, Spain; Garcia-Mora, L., Fuerzas Aerom?viles del Ej?rcito de Tierra, Spain; Current Aeromedical Issues in Rotary Wing Operations; August 1999, pp. 20-1 - 20-8; In English; See also 20000011735; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

Back pain is a widespread problem among industrialized countries. Incidence of back pain is between 60 and 80%. Prevalence rate does not exceed 35% of the general population. It was determined that back pain is twice more frequent in helicopter pilots than in the general population. Many papers reported prevalence rates in excess of 50%, many reported prevalence exceeding 75%, and pain in the lumbar area is the most common experienced by the pilots. Most of these studies have been made through questionnaires purely subjective in regards of data collection, performed in the aircrews immediately after flight. One of the papers, performed in the Fuerzas Aeromoviles del Ejercito de Tierra (F.A.M.E.T.) showed figures up to 78% of pain related to helicopter flying activities and 60% of the total number referred to lumbar area. Among military helicopters aircrew world-wide, backache is perceived as so common that the majority of sufferers accept it as an occupational nuisance and rarely seek medical advise by the flight surgeon. An interesting work to prove that poor posture in flight is an important factor in etiology of low back pain was made. Studies of 18 pilots in the AH-1S helicopter flying alternately in the gunner's seat were made, where they maintain a vertical sitting and in the pilot's seat, where they lean forward and to the left in order to operate the controls. The intensity of the back pain was great and the onset was quicker in the pilot's seat than in the gunner's position. The constantly maintained asymmetrical position does not permit relaxation of the spinal musculature, this situation probably leads to spasm of paraspinous musculature, which become fatigued, and the resultant is a straightening of the normal lumbar lordosis. The purpose of this study will be to compare the right and left side lumbar muscular activity in helicopter pilots under real flight conditions in order to objectively prove the effects of asymmetrical posture on the musculoskeletal system by using surface electromyography and to correlate lumbar muscular activity with environmental

and other variables such as type of flight, type of helicopter, flight time, age, physical fitness and height.
Derived from text
Back Injuries; Pain; Musculoskeletal System; Aircraft Pilots; Electromyography; Computer Programs

20000011754 COMALAT, Villacoublay-Air, France
ALAT HELICOPTER PILOT RACHIALGES: RESULTS OF AN ENQUIRY CONCERNING 560 ANSWERS *[LES RACHIALGIES DU PILOTE D'HELICOPTERE DE L'ALAT: RESULTATS D'UNE ENQUETE A PROPOS DE 560 REPONSES]*
Seynaeve, A., COMALAT, France; Burlaton, J. P., Hopital d'Instruction des Armees, France; Dolet-Ferraton, D., Centre Principal d'Expertises Medicales du Personnel Navigant de l'Aeronautique, France; Current Aeromedical Issues in Rotary Wing Operations; August 1999, pp. 21-1 - 21-11; In French; See also 20000011735; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

The analysis about these results compared with the previous ones (1976) allows to point out that rachialgies of helicopter pilots are prevailing and are increasing from 49,15% to 66% (+17%). This increase implies both isolated cervicalgies (+7,20%) and locations at two levels: the back and the neck. But isolated lombalgies are decreasing (-16,5%). The increase of cervicalgies could be explained by the importance of the night flight; 40% of flight hours are out when equipped with night vision goggles, the weight of which (980 g) is added to the helmet's one. In other respects, the technological improvement of the helicopters fleet, thanks to the reducing of vibrations (generalization of plastic blades among others) has given reducing of lombalgies.
Author
Aircraft Pilots; Spinal Cord; Back Injuries; Aerospace Medicine; Neck (Anatomy); Night Flights (Aircraft)

20000011757 Army Aeromedical Research Lab., Fort Rucker, AL USA
UTILIZATION OF MEDICAL SUPPORT EQUIPMENT ON BOARD ARMY ROTARY-WING AIRCRAFT
Licina, Joseph R., Army Aeromedical Research Lab., USA; Hall, Bruce D., Universal Energy Systems, Inc., USA; Murphree, K. Blake, Universal Energy Systems, Inc., USA; Current Aeromedical Issues in Rotary Wing Operations; August 1999, pp. 24-1 - 24-6; In English; See also 20000011735; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

The U.S. Army Airworthiness Certification and Evaluation (ACE) program at the U.S. Army Aeromedical Research Laboratory (USAARL) is designed to evaluate medical life support equipment for compatibility within the rotary-wing aviation or medical evacuation (MEDEVAC environment. The program goes beyond any prior validation of medical equipment for use within the controlled hospital environment, and assesses the equipment in the context of the military environment, from the supply and distribution chain, through storage and use in field conditions. The end product is an assessment that assures the safety of the aircraft and its subsystems, the aircraft crew, the device itself, and ultimately, the patient. Since the program's inception in 1983, standards have evolved to better reflect the actual rotary-wing operational environment. This evolution challenges manufacturers striving to produce viable products to meet both hospital and in-flight requirements in the military and civilian sectors. From July 1992 to August 1998, 24 medical devices including monitor/defibrillators, infusion pumps, vital-signs monitors, and ventilators were tested under specified conditions of temperature, humidity, altitude and vibration (MIL-STD-810D and 810E). Electromagnetic emissions and susceptibility were measured (MIL-STD-461C, 461D), and human factors (MIL-STD-1472D) were evaluated. The devices were flight tested in the USAARL JUH-60A MEDEVAC helicopter. Thirty-two percent of the medical devices failed at least one environmental test. Ninety-one percent of the devices failed to meet the 461C and 461D standards. Only three devices were tested at the new 200 V/m radiated susceptibility level, but all failed. Failures included excessive conducted and radiated emissions and susceptibility to radiated emissions.
Author
Aerospace Medicine; Medical Equipment; Armed Forces (United States); Human Factors Engineering; Uh-60a Helicopter; Environmental Tests; Medical Services

20000011767 Royal Air Force, Personnel and Training Command Headquarters, Gloucester, UK
MOULDED LUMBAR SUPPORTS FOR AIRCREW BACKACHE: COMPARISON OF EFFECTIVENESS IN FIXED AND ROTARY WING AIRCREW
Graham-Cumming, A. N., Royal Air Force, UK; Current Aeromedical Issues in Rotary Wing Operations; August 1999, pp. 35-1 - 35-11; In English; See also 20000011735; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

This study was intended to compare the effectiveness of the individually moulded lumbar support in ejection seat aircrew with its effectiveness in other aircrew groups. Details of all currently British military aircrew issued with individually moulded lumbar supports between 1 January 1986 and 31 January 1995 were obtained from records held at the Royal Air Force Aviation Medicine Training Center, where supports have been manufactured since 1976.
Derived from text
Lumbar Region; Supports; Back Injuries; Flight Crews; Rotary Wing Aircraft; Fixed Wings; Aerospace Medicine

20000032389 Air Force Research Lab., Biodynamics and Acceleration Branch, Wright-Patterson AFB, OH USA
THE AFRL BIODYNAMICS DATA BANK AND MODELING APPLICATIONS
Buhrman, John R., Air Force Research Lab., USA; Models for Aircrew Safety Assessment: Uses, Limitations and Requirements; August 1999, pp. 1-1 - 1-4; In English; See also 20000032388; Copyright Waived; Avail: CASI; A01, Hardcopy; A03, Microfiche

The Air Force Research Laboratory (AFRL) has studied the response of human volunteers and human surrogates to impact accelerations for over thirty years. The results of this research have been used to enhance the design of escape, crash protection, and life support systems, while providing invaluable biodynamic response data for the development and validation of impact simulation and injury models. The data that have been collected include accelerations, forces, and motions from in-house tests conducted on man-rated test facilities, including both a horizontal impulse accelerator and vertical deceleration tower. The test data and related summary information from these tests have been compiled and entered into a data bank residing on a server using MS Access, Excel, and Visual Basic software. The compilation of data and related software are referred to as the Biodynamics Data Bank (BDB). The contents of the BDB include general information describing the objective, test matrix, and results from seventy in-house test programs. Also included are the time history and peak biodynamic response data collected during these programs, encompassing approximately 5,000 impact tests. Anthropometry measurements from over 200 test subjects and bibliographic information from 10,000 related references are also included. Slow-motion videos of the tests are currently being digitized as AVI files for future entry into the BDB. Plans also include the scanning and subsequent entry of documentation photographs that will provide a visual image of each test set-up. To provide the user with more efficient access to the BDB, a test index has been developed which contains a complete list of all test parameters including the type of seat fixture, restraint system, and input acceleration profile. This index can be used to perform searches to create data sets of tests with specific parameters, thus enabling the researcher to address specific issues of interest. These features make the Biodynamics Data Bank an ideal source of test data for computer model development and validation.
Author
Anthropometry; Computerized Simulation; Biodynamics; Data Bases; Impact Tests; Impact Acceleration; Physiological Responses; Information Dissemination

20000032402 Defence and Civil Inst. of Environmental Medicine, Toronto, Ontario Canada
A MODEL OF CARDIOVASCULAR PERFORMANCE DURING SUSTAINED ACCELERATION
Walsh, C., Ryerson Polytechnic Univ., Canada; Cirovic, S., Toronto Univ., Canada; Fraser, W. D., Defence and Civil Inst. of Environmental Medicine, Canada; Models for Aircrew Safety Assessment: Uses, Limitations and Requirements; August 1999, pp. 14-1 - 14-9; In English; See also 20000032388
Report No.(s): DCIEM-98-P-XX; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

During aerial combat maneuvers, G(z) can cause visual impair-

ment or loss of consciousness (G-LOC). Anti-G suits, positive pressure breathing, and anti-G straining maneuvers reduce the risk of G-LOC. However, complex G-profiles are problematic. To assist in designing G-protective measures for such profiles, we are developing a model of human cardiovascular performance. We present preliminary results from a model that deals with the mechanical aspects of cardiovascular response to G(z). Physiological reflexes are neglected. We consider a closed loop vascular network with a time varying elastance heart model. Blood flow is modeled by a one-dimensional (1-D) approximation: a pair of first order partial differential equations govern continuity and momentum. The blood pressure is determined by the external pressure and a tube law. The dominant physical phenomenon is wave propagation. The vasculature is modeled as a network of uniform flexible tubes. Valves are placed at the entrances and exits to the ventricles, and in the veins. The equations are solved numerically using a split coefficient matrix method. The algorithm is first order, and it is suited to wave propagation. The boundary conditions are implemented using the method of characteristics. The results show cardiac output falling as G(z) increases and rising again when G(z) is reduced. Because there are no physiological reflexes, the central arterial pressure rises and falls with cardiac output, rather than being regulated to its physiological value. G-suit inflation, during periods of high G(z), returns the cardiac output to resting values when both the lower body and abdomen are covered. Protection is significantly reduced if only the lower body is covered. Simulations, in which Gz increases from 1G to 4G, are only plausible when there is at least one valve in the inferior vena cave.
Author
Cardiovascular System; Physiological Responses; Biological Models (Mathematics); Gravitational Effects; Protective Clothing; Safety Devices; Human Factors Engineering; Simulation

20000032403 Ryerson Polytechnic Univ., Dept. of Mechanical Engineering, Toronto, Ontario Canada
EFFECT OF HIGH +GZ ACCELERATIONS ON THE LEFT VENTRICLE
Behdinan, K., Ryerson Polytechnic Univ., Canada; Tabarrock, B., Victoria Univ., Canada; Fraser, W. D., Defence and Civil Inst. of Environmental Medicine, Canada; Models for Aircrew Safety Assessment: Uses, Limitations and Requirements; August 1999, pp. 15-1 - 15-9; In English; See also 20000032388; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

During certain maneuvers, fighter pilots are subjected to high accelerations reaching 10g levels. The effect of this acceleration on the left ventricle is most severe when it is directed along the body z axis. Under such accelerations it is difficult for the heart to function and supply the body with blood and further more there is concern that the heart may suffer tissue tear as a result of high stresses on the heart tissue. In this study a detailed finite element analysis is carried out to determine the stress state of the left ventricle under high Gz loading. To develop the FE model, surface geometry data was acquired from view Point Data Lab in Utah. The surface data for the interior and the exterior of the left ventricle was then used with a software from XYZ Scientific Application Inc. of Livermore to develop a 3D FE model. The model is made up of 3830 solid elements with three layers between the inner and the outer surfaces. Finite element results for deflections, strains and stresses are obtained for a number of acceleration levels. The analysis accounts for geometric nonlinearities and uses the updated Lagrangian method in the MARC finite element program.
Author
Finite Element Method; Heart Function; Gravitational Effects; Human Body; Biological Models (Mathematics); Physiological Responses; Stress (Physiology); Aircraft Maneuvers

20000032404 Defence and Civil Inst. of Environmental Medicine, Toronto, Ontario Canada
A MODEL OF CEREBRAL BLOOD FLOW DURING SUSTAINED ACCELERATION
Cirovic, S., Toronto Univ., Canada; Walsh, C., Ryerson Polytechnic Univ., Canada; Fraser, W. D., Defence and Civil Inst. of Environmental Medicine, Canada; Models for Aircrew Safety Assessment: Uses, Limitations and Requirements; August 1999, pp. 16-1 - 16-7; In English; See also 20000032388
Report No.(s): DCIEM-98-P-XX; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

Radial accelerations generated in modern combat aircraft maneuvers (Gz) may result in impaired vision or loss of consciousness (G-LOC). We are interested in developing mathematical models of cerebral blood flow during exposure to Gz. Our previous model showed that intracranial vascular resistance does not change with Gz since the vessels are protected from collapse by the cerebrospinal fluid and that reduction of the blood flow to the brain is mainly due to the increased vascular resistance of the large extracranial veins. Based on the previous results, we propose a model with simplified presentation of the arteries and intracranial vessels and a more detailed description of the jugular veins. The extracranial arteries are accounted for by the hydrostatic pressure drop from the heart to the head level. The intracranial vessels are represented by a resistance independent of the mechanical effects of Gz. However, a model of cerebral autoregulation is incorporated, which involves active change in the cranial vascular resistance in reaction to the change in blood pressure at the head level. The jugular veins are modeled using one dimensional equations of fluid dynamics and a non-linear relation between the transmural (blood minus external) pressure and the local vessel cross-sectional area. The central arterial and venous pressures are taken to be 105 mmHg and 5 mmHg respectively and Gz was varied from -5 to +10. To simulate the effects of positive pressure breathing, blood pressures at the arterial and venous ends of the model were elevated by the same amount, so that the perfusion pressure was always maintained at 100 mmHg. The model is successful in reproducing the drop in cerebral blood flow with +Gz. This reinforces our belief that the elevated venous resistance plays a significant role in G-LOC. The autoregulation has a positive impact at moderate +Gz but is ineffective at higher +Gz. This is mainly due to the fact that the venous resistance becomes absolutely dominant at high +Gz and a further decrease in the cranial vascular resistance makes little difference. The model predicts an increase in the blood flow in the case when the central venous and arterial pressures are elevated. We attribute this to the fact that an elevated central venous pressure prevents the venous collapse and maintains the extracranial veins patent.
Author
Mathematical Models; Acceleration Stresses (Physiology); Aircraft Maneuvers; Blood Flow; Blood Pressure; Brain Circulation; Cardiovascular System

20000032405 Engineering Services, Inc., Toronto, Ontario Canada
LINEAR AND NONLINEAR MODELS OF THE PHYSIOLOGICAL RESPONSES TO NEGATIVE-TO-POSITIVE GZ TRANSITIONS
Kapps, A., Engineering Services, Inc., Canada; Fraser, W. D., Defence and Civil Inst. of Environmental Medicine, Canada; Models for Aircrew Safety Assessment: Uses, Limitations and Requirements; August 1999, pp. 18-1 - 18-6; In English; See also 20000032388; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

The identification and modeling of experimental data for negative-to-positive Gz (Push-Pull) transitions discussed in this paper is aimed at predicting typical and atypical physiological responses in order to develop Push-Pull countermeasures. A novel analysis of Push-Pull data in both the time and frequency domains was developed. Eye-level blood pressure dynamics in response to Push-Pull transitions differ significantly from subject to subject. This individual sensitivity is much less profound in a sub-group of the tested subjects. Overall, the match between the predicted and measured eye-level blood pressure is much better with low Gz gradients than in the case of large Gz gradients. A model with a transfer function of low order (3 by 3) may be sufficient to match the behavior of eye-level blood pressure under both Push-Pul1 and positive Gz maneuvers. However, nonlinear models are required to fit blood pressure response data in a sub-group of subjects.
Author
Computerized Simulation; Mathematical Models; Flight Crews; Acceleration Stresses (Physiology); Acceleration Tolerance; Aerospace Medicine; Gravitational Effects

20000032408 Defence and Civil Inst. of Environmental Medicine, Toronto, Ontario Canada
A PHYSIOLOGICAL DATA ANALYSIS TOOLBOX FOR THE ANALYSIS OF ACCELERATION DATA
Fraser, W. D., Defence and Civil Inst. of Environmental Medicine, Canada; Askari, V., Engineering Services, Inc., Canada; Lu, Z., Engineering Services, Inc., Canada; Kapps, A., Engineering Services, Inc., Canada; Models for Aircrew Safety Assessment: Uses,

Limitations and Requirements; August 1999, pp. 21-1 - 21-9; In English; See also 20000032388; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

As an alternative to using traditional first principle-based modeling of a protected subject's physiological responses to real-life acceleration trains (both positive and negative-to-positive Gz transitions), a nontraditional systematic approach is being designed to facilitate the evaluation and prediction of human cardiovascular responses to G-suit and Positive Pressure Breathing (PPB) pressure schedules. The purpose of this work is to develop novel improved Anti-G protection schedules optimized for individual pilots in general and push-pull protection in particular. The proposed nontraditional systematic models are based on input-output relationships supplemented by expert knowledge. Therefore, both the experimental design and physiological data processing architecture are critical in this project. Six subjects (two females and four males) participated in the initial experimental effort. Persistently excited non-linear G-suit and PPB pressure schedules, which are not direct linear functions of Gz levels, have been applied using two types of electronic valves: (i) a combined Breathing Regulator and Anti-G valve (BRAG valve); and (ii) two custom-designed electronic (SAMCAV)- valves. The recorded parameters were heart level blood pressure, ECG, respiratory rate, G-suit and PPB pressures. Among other issues, this paper describes a Physiological Data Analysis Toolbox (Phi-DAT) that integrates statistical, fuzzy and linear trend investigations with higher-order spectrum analysis of the experimental data. -DAT has been designed as a preprocessor of the nontraditional systematic modeling architecture and proven very efficient in establishing correlation and trend dependencies between the non-linear pressure schedules employed and responses obtained.
Author

Physiological Responses; Acceleration Stresses (Physiology); Gravitational Physiology; Models; Computerized Simulation; Pressure Breathing; Pressure Suits; Flight Crews; Data Processing; Human Factors Engineering

20000032410 Air Force Research Lab., Human Effectiveness Directorate, Brooks AFB, TX USA

MATHEMATICAL MODELS FOR PREDICTING HUMAN TOLERANCE TO SUSTAINED ACCELERATION

Burton, Russell R., Air Force Research Lab., USA; Models for Aircrew Safety Assessment: Uses, Limitations and Requirements; August 1999, pp. 23-1 - 23-6; In English; See also 20000032388; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

Mathematical models that predict G-level and G-duration tolerances are reviewed. These model are subdivided into relaxed and straining tolerances. The latter tolerance predicts G levels of subjects that are performing an anti-G straining maneuver. These models are equations based on hydrostatic pressure mathematics G = (P(a) * d)/h. where: G = +G level tolerance; P(a) = mean arterial blood pressure in mm Ha (100) at heart level d = density of Hg (i.e. 13.6); and, h= vertical distance in mm (350 mm). The tolerance model is based on tolerance data obtained from subjects to the same continuous of G to fatigue. These G tolerance models were validated using published data. These G-level and duration models predict, with hugely accuracy, tolerances for relaxed or straining subjects using various anti-G protective systems/methods.
Author

Mathematical Models; Human Tolerances; Acceleration Stresses (Physiology); Human Factors Engineering; Acceleration Tolerance; Gravitational Effects

20000032411 BC Research, Inc., Vancouver, British Columbia Canada

A BIOMECHANICAL APPROACH TO EVALUATING THE HEALTH EFFECTS OF REPEATED MECHANICAL SHOCKS

Morrison, J. B., Simon Fraser Univ., Canada; Robinson, D. G., BC Research, Inc., Canada; Nicol, J. J., BC Research, Inc., Canada; Roddan, G., BC Research, Inc., Canada; Martin, S. H., BC Research, Inc., Canada; Springer, M.-J.-N., BC Research, Inc., Canada; Cameron, B. J., BC Research, Inc., Canada; Albano, J. P., Army Aeromedical Research Lab., USA; Models for Aircrew Safety Assessment: Uses, Limitations and Requirements; August 1999, pp. 24-1 - 24-8; In English; See also 20000032388
Contract(s)/Grant(s): DAMD17-91-C-1115; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

Operators of industrial and military vehicles are routinely exposed to repeated mechanical shocks. Numerous studies have associated these exposures with an increased incidence of low back pain and degenerative disorders of the spine. This paper describes a method of evaluating the effect of repeated mechanical shocks on the health of vehicle operators. The method provides a health hazard assessment (HHA) in which the risk of injury to the operator is related to the acceleration measured at the vehicle seat. The HHA process consists of four stages. Dynamic response models are used to predict accelerations of the lumbar spine in the x, y and z axes from accelerations at the seat. Compressive forces at the L4/L5 vertebral joint are estimated from peak lumbar accelerations using relationships derived from biomechanical analysis. The effect of repeated compressive loading is calculated using a dose model based on the fatigue failure properties of tissue and the compressive strength of the vertebral joint. The risk of injury to the operator is then determined from the accumulated compressive dose, the fatigue life of the SyStem, the variance of vertebral joint strength data, and the cumulative probability of failure. The HHA model can be used to predict the risk of injury from a single exposure or from the cumulative effects of a lffe time. The HHA was tested using a range of repeated shock profiles. Results indicate that the risk of injury predicted by the HHA compares favorably with human tolerance data obtained from acute exposures and with injury incidence data obtained from chronic exposure of vehicle operators.
Author

Mechanical Shock; Biodynamics; Health; Human Tolerances; Human Factors Engineering; Occupational Diseases; Operational Hazards

20000032413 Institute for Human Factors TNO, Soesterberg, Netherlands

MODELLING MOTION SICKNESS

Bos, J. E., Institute for Human Factors TNO, Netherlands; Bles, W., Institute for Human Factors TNO, Netherlands; Models for Aircrew Safety Assessment: Uses, Limitations and Requirements; August 1999, pp. 26-1 - 26-4; In English; See also 20000032388; Copyright Waived; Avail: CASI; A01, Hardcopy; A03, Microfiche

To analyze and or anticipate air crew performance per- and post-flight, we present a model that predicts spatial orientation and motion sickness. We first demonstrate a close linkage between spatial orientation and motion sickness, resulting in the postulation that sickness only arises when sensed and expected estimates of gravity change differently. Including observer theoretical considerations, this concept lead to predictions of seasickness corresponding with experimental data. The model offers the possibility to predict all types of motion sickness, including simulator sickness.
Author

Models; Motion Sickness; Flight Crews; Acceleration Stresses (Physiology); Human Performance; Computerized Simulation

20000032414 Army Research Lab., Survivability/Lethality Analysis Directorate, Aberdeen Proving Ground, MD USA

NEW METHODOLOGY FOR THE ASSESSMENT OF BATTLEFIELD INSULTS AND INJURIES ON THE PERFORMANCE OF ARMY, NAVY, AND AIR FORCE MILITARY TASKS

Neades, David N., Army Research Lab., USA; Klopcic, J. Terrence, Army Research Lab., USA; Davis, Edward G., Army Research Lab., USA; Models for Aircrew Safety Assessment: Uses, Limitations and Requirements; August 1999, pp. 28-1 - 28-11; In English; See also 20000032388; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

To address known limitations, shortfalls, and lack of a comprehensive standardized casualty assessment methodology, across the military services as well as within services, a new methodology has been developed for triservice use that allows the assessment of soldier performance following weapon-induced injury. This new methodology, embodied in the Operational Requirement-based Casualty Assessment (ORCA) modeling system, permits casUalty assessments to be performed in a consistent manner across virtually all types of military platforms, jobs, and weapon-induced threats. The ORCA computer code enables the analyst to calculate anatomical damage and the effect on individual performance as a result of exposure to one or more insult types including kinetic energy (fragments), chemical, and blast overpressure. The ORCA modeling system incorporates previously developed as well as newly developed injury criteria models, algorithms, and scoring systems to characterize human bioresponse to trauma from various types of

battlefield insults and derives estimates of soldier
Author
Injuries; Human Performance; Warfare; Computerized Simulation; Casualties

20000032415 Air Force Research Lab., Human Effectiveness Directorate, Brooks AFB, TX USA
DOSIMETRY MODELS USED TO DETERMINE THE BIOEFFECTS OF DIRECTED ENERGY EXPOSURE
Hurt, William D., Air Force Research Lab., USA; Mason, Patrick A., Veridian, USA; Models for Aircrew Safety Assessment: Uses, Limitations and Requirements; August 1999, pp. 29-1 - 29-7; In English; See also 20000032388
Contract(s)/Grant(s): F33615-90-C-0604; F41624-96-C-9009;
Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

Determining the bioeffects of directed energy exposure is essential for establishing safety standards to protect military personnel and the general public. However, internal temperature measurements are invasive in nature, and therefore difficult or impossible to obtain. Furthermore, it would be unethical to expose human subjects to those field parameters producing substantial thermal increases. An alternative method to obtain the necessary information is the development of accurate anatomical models incorporating permittivity values for the major tissue types. Using the VisableMan dataset available from the National Library of Medicine, we have converted each of the 1870 photographic images into a color-coded image representing permittivity values. Each color corresponds to an entry in a look-up-table containing the permittivity properties of that tissue. The resulting dataset is imported into a mathematical model to predict electrical fields and specific absorption rate (SAR) values. Various mathematical models are available including the finite-difference time-domain code. Processing such a large dataset is best accomplished using parallel computer system. Combining anatomical and mathematical models provide the technology required to begin understanding the distribution of localized SAR values in the human resulting from directed energy exposure.
Author
Dosimeters; Mathematical Models; Human Beings; Biological Effects; Electromagnetic Radiation; Radiation Dosage

20000032416 Veridian, San Antonio, TX USA
A SUBMODEL FOR COMBAT CASUALTY ASSESSMENT OF OCULAR INJURY FROM LASERS
Miller, R. E., II, Veridian, USA; Carver, B., Veridian, USA; Models for Aircrew Safety Assessment: Uses, Limitations and Requirements; August 1999, pp. 30-1 - 30-11; In English; See also 20000032388;
Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

In an effort to standardize casualty assessments for DoD, the Joint Service Technical Coordination Group/Munitions Effectiveness and Aircraft Survivability Crew Casualty Working Group (CCWG) developed the Operational Requirements based Casualty Assessment (ORCA) model. The ORCA system consists of a functioning software code that will predict the effects of insult-to-injury-to-operational casualty from various types of trauma at specific times post-insult. As an integral part of ORCA, this submodel was designed to predict the probability for ocular injury from insult on the battlefield by directed energy, i.e., lasers, and assess casualty status. A unique, integrated, and multifaceted approach was devised to compute the effects of laser insult on the elemental capabilities of vision, or visual taxons. The methodology is based on using equations and algorithms to calculate a functional index of ocular damage, utilizing this index to quantify the effects of combat injuries on the visual taxons, and applying the resultant values to a notional scale to determine the potential for combat casualty in terms of mission completion. This submodel also provides a capability to differentiate operational casualties from medical casualties in a format that is compatible with the ORCA system.
Author
Casualties; Mathematical Models; Injuries; Human Performance; Combat; Eye (Anatomy)

20000032417 Air Force Research Lab., Human Effectiveness Directorate, Wright-Patterson AFB, OH USA
BURN PREDICTION USING BURNSIM AND CLOTHING MODELS
Knox, F. S., Air Force Research Lab., USA; Reynolds, D. B., Wright State Univ., USA; Conklin, A., Veridian, USA; Perry, C. E., Air Force Research Lab., USA; Models for Aircrew Safety Assessment: Uses, Limitations and Requirements; August 1999, pp. 31-1 - 31-17; In English; See also 20000032388; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

The development of BURNSIM, an interactive burn prediction model, has been previously presented at SAFE. Recently, a user who was incorporating BURNSIM into a larger Crew Casualty Model (ORCA) came to us for documentation of BURNSIM's validation. This prompted us to pull together several previously unpublished studies of BURNSIM's ability to accurately predict both human and porcine (pig) burns. The paper discussed the degree to which BURNSIM's predictions agree with data published by: Stoll (human), University of Rochester Atomic Energy Project (pig), Fort Knox (human), Moritz and Henriques (pig), and Knox etal (pig). This paper adds to that discussion by introducing efforts to model the protective effects of clothing. Three approaches have been taken: first, making experimental observations of how much heat is transferred through fabric to a sensor or pig skin: second, treating clothing as a simple filter and finally, describing clothing analytically as a multi-layered system through which heat must flow. Each method has its uses and problems. For example, the analytical model is the most general but requires that the user specify many things about the clothing system e.g. size of spaces, thermal properties of the fabric etc. These are not often known and may be difficult to obtain. BURNSIM was able to predict with reasonable accuracy when the initial conditions and thermal inputs are adequately defined.
Author
Burns (Injuries); Computer Programs; Mathematical Models; Casualties; Protection; Predictions

20000032418 Royal Military Coll. of Science, Shrivenham, UK
THERMAL OUTPUT OF PYROTECHNIC COMPOSITIONS AND EVALUATION OF SKIN BURNS
Lawton, B., Royal Military Coll. of Science, UK; Merrifield, R., Health and Safety Executive, UK; Wharton, R. K., Health and Safety Executive, UK; Models for Aircrew Safety Assessment: Uses, Limitations and Requirements; August 1999, pp. 32-1 - 32-12; In English; See also 20000032388; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

This paper presents a method of computing the heat dose for first, second, and third-degree burns from convection or radiation sources. Henriques' theory of skin burns is used with a simple numerical model of one-dimensional, transient heat conduction through skin. Allowance is made, where necessary, for heat absorption due to penetration of the skin by short wavelength radiation. The theory is used to compute the quantity-distance-burns relation for fires burning various pyrotechnic compositions of commercial and military interest.
Author
Burns (Injuries); Pyrotechnics; Radiation Damage; Human Performance; Radiation Injuries; Skin (Anatomy); Conductive Heat Transfer; Radiation Dosage

20000032419 JAYCOR, San Diego, CA USA
BIOMECHANICAL MODELING OF INJURY FROM BLAST OVERPRESSURE
Stuhmiller, James H., JAYCOR, USA; Masiello, Paul J., JAYCOR, USA; Ho, Kevin H., JAYCOR, USA; Mayorga, Maria A., Walter Reed Army Inst. of Research, USA; Lawless, Nancy, Walter Reed Army Inst. of Research, USA; Argyros, Greg, Walter Reed Army Inst. of Research, USA; Models for Aircrew Safety Assessment: Uses, Limitations and Requirements; August 1999, pp. 33-1 - 33-7; In English; See also 20000032388
Contract(s)/Grant(s): DAMD17-96-C-6007; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

The loading of the body by blast overpressure, often generated by explosives or weapon noise, can rapidly collapse the air-containing organs of the body and cause local injury. These effects can range from isolated pathologies, with no observable physiological consequences, to rupture of critical organs and death. Following World War II, animal models were used to study lethality, while in the past two decades the US Army Medical Research and Materiel Command has used animal models to study injury. The lethality data was correlated with pressure-duration characteristics of the free field blast, but these correlations become ambiguous in reverberant environments. Correlations have been proposed based on the

motion of the thorax, but without a biomechanical basis, they do not provide insight into injury location or scaling with species and gender. A model of the thoracic injury process has been developed that provides both a biomechanical understanding and a good correlation of experimental observation. This paper reviews the mathematical model, the data supporting the choice of material properties, and the correlation of calculated internal stress with observed injury.
Author
Biodynamics; Blast Loads; Injuries; Mathematical Models; Pathology; Animals; Computerized Simulation; Explosives; Casualties

20000032420 Air Force Research Lab., HEPR, Brooks AFB, TX USA
ALTITUDE DECOMPRESSION SICKNESS (DCS) RISK ASSESSMENT COMPUTER (ADRAC)
Petropoulos, L. J., Air Force Research Lab., USA; Kannan, N., Texas Univ., USA; Pilmanis, A. A., Air Force Research Lab., USA; Models for Aircrew Safety Assessment: Uses, Limitations and Requirements; August 1999, pp. 27-1 - 27-6; In English; See also 20000032388; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

Decompression sickness (DCS) is caused by exposure to significant reductions in environmental pressure. These situations are encountered during diving, high altitude exposures or artificially induced pressure changes in hyperbaric or hypobaric chambers. For large and rapid pressure reductions, supersaturation occurs as a result of the inability of tissue gas exchange processes to expel excess nitrogen. These gases, which come out of solution when tissues are sufficiently supersaturated, collect as bubbles in the tissue. The size and location of these bubbles are thought to have a significant effect on the resulting DCS symptoms. The risks can be minimized or prevented with sufficient denitrogenation by prebreathing pure oxygen before such exposures. The risk of DCS increases with extended exposure times, very high altitudes, and greater physical activity during the exposure. The assessment of DCS risk for both civilian and military personnel under specified flight protocols is a critical problem that the USAF deals with on a regular basis. To provide answers to these questions, and also to obtain a clearer understanding of the effects of denitrogenation, the High Altitude Protection Function of the Air Force Research Laboratory is developing an appropriate model to predict DCS risk using physical and physiological principles.
Author
Decompression Sickness; Models; Mathematical Models; Computerized Simulation; Human Factors Engineering; Physiological Responses

20000032687 Flugmedizinisches Inst. der Luftwaffe, Fuerstenfeldbruck, Germany
PHYSIOLOGICAL CONSEQUENCES: CARDIOPULMONARY, VESTIBULAR, AND SENSORY ASPECTS
Welsch, H., Flugmedizinisches Inst. der Luftwaffe, Germany; Albery, W., Air Force Research Lab., USA; Banks, R. D., Biodynamic Research Corp., USA; Bles, W., Institute for Human Factors TNO, Netherlands; Human Consequences of Agile Aircraft; March 2000, pp. 4 - 1 - 4 - 8; In English; See also 20000032683; Copyright Waived; Avail: CASI; A02, Hardcopy

Discussing the physiological consequences of enhanced fighter maneuverability (EFM), aspects of cardiopulmonary reactions will be seen during high G maneuvers, especially the combination of negative G-load followed by high G-onset maneuvers ('push-pull'). The aircrafts' capability to reach high altitude within a very short time (due to the lift to weight ratio of more than 1) may produce new problems even during normal aircraft operation, e.g. decompression sickness (DCS). The incidence of vestibular problems may be increased by unconventional acceleration exposures Sensory stimulations may be induced by high acceleration alterations in the roll, pitch, and yaw axis. The support by an advanced G-protection garment will be needed. For the 'care free' handling the advanced G-protection device must work without any delay in time even during high acceleration transitions, must secondly include high altitude protection, and thirdly must ensure pilot comfort. Furthermore special training devices are required such as the human centrifuge as a dynamic flight simulator (DFS) with a fully gimballed system, and a spatial (dis)orientation device with a fully three-axes gimballed system. Pilot selection and medical survey with high sophisticated diagnostic tools will become more and more important. Last not least the need of special physical training will be required to power, to train the cardiovascular reflexes, and to increase psychomotoric stability and mental mobility.
Author
Physiological Effects; Aircraft Maneuvers; Flight Characteristics; Flight Fatigue; Human Factors Engineering; Human Centrifuges; Gravitational Effects; Aircraft Pilots; Pilot Performance

20000033305 Army Aeromedical Research Lab., Fort Rucker, AL USA
THE EFFICACY OF AMPHETAMINES FOR 64 HOURS OF SUSTAINED OPERATIONS
Caldwell, John A., Army Aeromedical Research Lab., USA; Individual Differences in the Adaptability to Irregular Rest-Work Rhythms/ Status of the Use of Drugs in Sleep-Wakefulness Management; March 2000, pp. 2 - 1 - 2 - 8; In English; See also 20000033303; Copyright Waived; Avail: CASI; A02, Hardcopy

Dextroamphetamine sulfate (Dexedrine(regitered trademark)) is a powerful central nervous system (CNS) stimulant that improves alertness and postpones the need for sleep. In aviation, where a high degree of alertness is essential during long flights, dextroamphetamine can counteract the decreased vigilance and attention, slowed reaction time, negative psychological mood, and sometimes perceptual disturbances associated with severe fatigue. Countermeasures other than dextroamphetamine have been tested to overcome these problems, but the most popular strategy, that of emphasizing proper work/rest management, is almost impossible to successfully implement due to the unpredictability of combat operations. Other potential measures such as brief periods of exercise only temporarily reduce the negative impact of sleep loss, while exposure to cold air or noise is virtually ineffective or, in the case of loud music, actually deleterious. Improving the physical fitness of personnel likewise does little to reduce the impact of sleep loss.
Author
Amphetamines; Central Nervous System Stimulants; Alertness; Countermeasures

20000033306 Air Force Hospital (251th), Athens, Greece
NON BENZODIAZEPINES HYPNOTICS: ANOTHER WAY TO INDUCE SLEEP
Kodounis, Antonios, Air Force Hospital (251th), Greece; Individual Differences in the Adaptability to Irregular Rest-Work Rhythms/ Status of the Use of Drugs in Sleep-Wakefulness Management; March 2000, pp. 3 - 1 - 3 - 8; In English; See also 20000033303; Copyright Waived; Avail: CASI; A02, Hardcopy

The third generation hypnotics, zolpidem and zopiclone can be used to optimize rest periods during sustained operations and help the military personnel. This is possible because these drugs provide a good quality of sleep, without residual effects in the morning after administration. A literature review of the possible limitations of use of these drugs in pilots has been presented.
Author
Drugs; Personnel; Sleep; Hypnosis

20000033307 Dortmund Univ., Inst. for Occupational Physiology, Germany
THE EFFECTS OF LOW FREQUENCY ELECTROMAGNETIC FIELDS ON THE MELATONIN SYNTHESIS IN MAN
Griefahn, Barbara, Dortmund Univ., Germany; Degen, Gisela, Dortmund Univ., Germany; Blaszkewicz, Meinolf, Dortmund Univ., Germany; Golka, Klaus, Dortmund Univ., Germany; Kuenemund, Christa, Dortmund Univ., Germany; Their, Ricarda, Dortmund Univ., Germany; Griefahn, Barbara, Dortmund Univ., Germany; Individual Differences in the Adaptability to Irregular Rest-Work Rhythms/ Status of the Use of Drugs in Sleep-Wakefulness Management; March 2000, pp. 4 - 1 - 4 - 6; In English; See also 20000033303; Copyright Waived; Avail: CASI; A02, Hardcopy

Some studies (mainly in rodents) have raised concerns regarding a carcinogenic potential of low-frequency electric and/or magnetic fields which may be related to the inhibition of melatonin synthesis. This hormone - isolated by Lerner et al. in 1958 [14] - is thought to exert an oncostatic effect probably by acting as a free radical scavenger [20, 21, 22]. The chronobiological properties of melatonin are much better founded. Melatonin mediates the entrainment (synchronization) of the periodic diurnal alterations of physiologic functions (core temperature, heart rates etc. [2, 4]). Moreover,

melatonin has probably numerous other functions which are as yet insufficiently studied (thermoregulation, cardiovascular and immune functions etc.) [6, 7].
Author
Electromagnetic Fields; Low Frequencies; Thermoregulation; Synchronism

20000033309 Etat-Major de la Marine, Antenne Programmes, Toulon, France
CAFFEINE TO SUSTAIN OPERATIONAL FATIGUE
Sicard, B., Etat-Major de la Marine, France; Lagarde, D., Centre d'Etudes et de Recherches de Medecine Aerospatiale, France; Batejat, D., Centre d'Etudes et de Recherches de Medecine Aerospatiale, France; Chauffard, F., Nestle Research Centre, Switzerland; Enslen, M., Nestle Research Centre, Switzerland; Doireau, P., Centre d'Etudes et de Recherches de Medecine Aerospatiale, France; Beaumont, M., Centre d'Etudes et de Recherches de Medecine Aerospatiale, France; Tachon, P., Nestle Research Centre, Switzerland; Ballevre, O., Nestle Research Centre, Switzerland; Individual Differences in the Adaptability to Irregular Rest-Work Rhythms/Status of the Use of Drugs in Sleep-Wakefulness Management; March 2000, pp. 6 - 1 - 6 - 3; In English; See also 20000033303; Copyright Waived; Avail: CASI; A01, Hardcopy

Sleep deprivation and desynchronization from circadian rhythm are common in military operation. Caffeine is the most widely used psychostimulant and may be useful in operational fatigue-coping strategies. In this paper we will review the current policies on caffeine in the military, then we will discuss effects and potential use of a slow release caffeine formulation.
Author
Caffeine; Sleep Deprivation; Military Operations; Circadian Rhythms

20000033312 Surrey Univ., School of Biological Sciences, Guildford, UK
ACUTE AND DELAYED EFFECTS OF MELATONIN: OPERATIONAL SIGNIFICANCE
Arendt, Josephine, Surrey Univ., UK; Middleton, Benita, Surrey Univ., UK; Stone, Barbara, Defence Evaluation Research Agency, UK; Individual Differences in the Adaptability to Irregular Rest-Work Rhythms/Status of the Use of Drugs in Sleep-Wakefulness Management; March 2000, pp. 9 - 1 - 9 - 6; In English; See also 20000033303; Copyright Waived; Avail: CASI; A02, Hardcopy

The primary function of melatonin in mammals is to convey information about the changing length of the night in the course of the year. Melatonin appears not to be essential for circadian organization but reinforces functions associated with darkness. In diurnal humans this of course included sleep and lowered body temperature. It may act as an adjunct to light for the maintenance of synchrony with the solar day. Exogenous melatonin can both advance and delay the timing of sleep and other circadian functions and appears to stabilise sleep to a 24h period taken daily at an appropriate time in free running conditions. However there is at yet little evidence that it can consistently synchronise free running strongly endogenous variables such as core temperature. Its effects on sleep in free run are complex, depend on circadian time of administration, and in part can be interpreted on a photoperiodic basis.
Author
Diurnal Variations; Circadian Rhythms; Sleep

20000098516 Swedish Defence Research Establishment, Stockholm, Sweden
PREDICTIONS FROM PHYSICAL FITNESS TESTS IMPACT OF AGE AND GENDER
Bergh, U., Swedish Defence Research Establishment, Sweden; Danielson, U., Swedish Defence Research Establishment, Sweden; Officer Selection; August 2000, pp. 6-1 - 6-5; In English; See also 20000098510; Copyright Waived; Avail: CASI; A01, Hardcopy

Physical fitness tests are employed in most armed forces; the purpose being to avoid persons with insufficient fitness. The predictive value is strongly influenced by the prevalence of the tested quality. In regard to physical work capacity, higher values are more prevalent among males compared to females and among younger people compared to older ones. At a prevalence of .9 for males and .4 for females, the success rate among those who passes the test would theoretically be 95% and 70%, respectively. Prevalence should be included when predicting the possible outcome of different tests. This theoretical example is in line with empirical findings. For example, among fire-fighters who had passed a treadmill test, the success rate in a smoke-diving task was 90% in age group 20-30 years, 78% in age group 3l-40 years, 69% in age group 41-50 years, and 30% in age group 51-60 years.
Author
Armed Forces; Age Factor; Physical Fitness; Human Performance; Performance Prediction; Qualifications; Sex Factor; Abilities

20000105061 Naval Air Warfare Center, Crew Systems Technology Dept., Patuxent River, MD USA
THE EFFECT OF AIRCREW AGE ON +GZ TOLERANCE AS MEASURED IN A HUMAN-USE CENTRIFUGE
Forster, Estrella M., Naval Air Warfare Center, USA; Shender, Barry S., Naval Air Warfare Center, USA; Forster, Estrella C., Center for Health Care Services, USA; Operational Issues of Aging Crewmembers; August 2000, pp. 1-1 - 1-10; In English; See also 20000105060; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

Pilots of high performance military aircraft are often exposed to positive acceleration stress (+Gz). This type of acceleration displaces blood in the head to foot direction. As the pressure in the vessels of the lower body increases, the vessels dilate, and a major portion of the blood from the upper part of the body is translocated to these lower vessels. The pooling of blood in the lower extremities translates into reduced cardiac output provoking the cardiovascular system, mainly by the activation of baroreceptor reflexes, to maintain adequate blood flow to the central nervous system (CNS) and thereby maintain normal brain function. The physiologic symptoms of acceleration stress range from petechia hemorrhages (burst capillaries present in the limbs) to loss of vision and ultimately loss of consciousness with potential fatal consequences when it occurs in flight. Mission effectiveness may also be affected by +Gz stress in that the lack of adequate blood flow to the CNS leads to degraded motor and cognitive performance. This degradation may then lead to aircraft accidents and incidents commonly labeled 'pilot error.' Hence, aircrew are routinely trained in the human-centrifuge to understand and better tolerate +Gz stress.
Derived from text
Flight Crews; Age Factor; Aging (Biology); Mental Performance; Pilot Performance; Operator Performance

20000105062 Institut de Medicine Aerospatiale Armee, Bretigny sur Orge, France
EVALUATION OF CREW MEMBERS AGING ON JET-LAG CONSEQUENCES
Lagarde, Didier, Institut de Medicine Aerospatiale Armee, France; Batejat, Denise, Institut de Medicine Aerospatiale Armee, France; Beaumont, Maurice, Institut de Medicine Aerospatiale Armee, France; Sicard, Bruno, Etat-Major de la Marine, France; VanBeers, Pascal, Institut de Medicine Aerospatiale Armee, France; Pierard, Christophe, Institut de Medicine Aerospatiale Armee, France; Ramont, Laurent, Institut de Medicine Aerospatiale Armee, France; Billaud, Philippe, Institut de Medicine Aerospatiale Armee, France; Chauffard, Francoise, Centre de Recherche, France; French, Johnatan, Armstrong Lab., USA; Operational Issues of Aging Crewmembers; August 2000, pp. 3B1-3B4; In English; See also 20000105060; Copyright Waived; Avail: CASI; A01, Hardcopy

Travel across multiple time zones triggers a disruption of the body's circadian timing mechanisms of crew members and military force. It entails a desynchronization syndrome which depends on individual sensitivity. Weakness and sleep disorders are usually affected and cognitive (mood and attention) and physical (power and endurance) performances can be decreased. The purpose of this study is to evaluate a possible effect of age on individual sensitivity for a jet-lag.
Derived from text
Crews; Age Factor; Aging (Biology); Jet Lag; Desynchronization (Biology); Physiological Responses

20000105063 Universidad Complutense, School of Medicine, Madrid, Spain
AGE DEPENDENT ALTERATIONS INDUCED BY TRANSMERIDIAN FLIGHTS IN AIRLINE PILOTS
Tresguerres, J. A. F., Universidad Complutense, Spain; Ariznavar-

reta, C., Universidad Complutense, Spain; Granados, B., Universidad Complutense, Spain; Martin, M., Universidad Complutense, Spain; Villanua, M. A., Universidad Complutense, Spain; Chiesa, J. J., Buenos Aires Univ., Argentina; Golombek, D. A., Buenos Aires Univ., Argentina; Cardinali, D. P., Buenos Aires Univ., Argentina; Operational Issues of Aging Crewmembers; August 2000, pp. 4-1 - 4-5; In English; See also 20000105060; Copyright Waived; Avail: CASI; A02, Hardcopy

Desynchronization among body rhythms and with the environment appears to be linked with jet lag, which may depend on many factors, including age, flight direction and number of time-zones crossed. To analyze this chronobiological state, we performed a multivariate analysis of the circadian system of airline pilots younger and older than 50 years, in Madrid-Mexico-Madrid (-7 time zones, n=12) and Madrid-Tokyo-Madrid (+8 time zones, n=21) flights. Telemetrical devices were used to record pilots' locomotor activity, skin temperature and heart rate, during the flights to and from destiny, and one day after returning to Madrid.In addition the excretion of 6 sulphatoxy melatonin and free cortisol was measured in 6 hourly intervals during the whole period. Time series were analyzed by cosinor and the rhythms were compared by ANOVA and Tukey contrasts. Age (under and over 50 years old) and flight direction groups were considered. Different psychometric tests were carried out at different times of the flights in order to know how pilots are affected by transmeridian flights. Subjective time estimation was also recorded, as well as other psychological variables including anxiety, tiredness and performance. Activity / rest and heart rate rhythms are easily adapted to the new time zones whereas temperature rhythms manifest a rigid response after the phase shifts. Subjective time tended to be overestimated without exhibiting a clear circadian component. Psychometric evaluation showed that desynchronization affects all the pilots. Some results show an age-related variability with more marked influence in younger pilots, while no consistent effects of the flight direction were found.
Author

Age Factor; Aging (Biology); Aircraft Pilots; Jet Lag

20000105064 Aeromedical Inst., Soesterberg, Netherlands
INFLUENCE OF AGE ON ALERTNESS AND PERFORMANCE DURING 3-DAY CROSS NORTH-ATLANTIC OPERATIONS
Valk, P. J. L., Aeromedical Inst., Netherlands; Operational Issues of Aging Crewmembers; August 2000, pp. 5-1 - 5-5; In English; See also 20000105060; Copyright Waived; Avail: CASI; A02, Hardcopy

From literature it is known that a relationship exists between a age and pilot's performance. Furthermore age correlates with shorter sleep, impaired sleep quality, difficulty in adapting to irregular work schedules and rapid time zone transitions. These factors may aggravate the effect of age and lead to impaired performance during flight duties. Data from North-Atlantic operations (59 pilots) were used to investigate the relationship between age and alertness and performance during long haul operations. Pilots were equipped with a palm top computer and an actigraph for subjective and objective measurement of quantity and quality of sleep, alertness, and performance on a vigilance dual-task. During the entire operation, no differences were found on subjective alertness between the younger and older pilots. Vigilance and tracking performance profiles appeared to be similar for both groups. Vigilance performance of older pilots was better after waking up and during the inbound leg. However, tracking performance of this group was worse before bedtime at stopovers and during the inbound leg. Performance was significantly correlated with age, but when correcting for baseline performance (home base), significancy almost disappeared. It was concluded that, although performance of older pilots impaired more durin the outbound flight as compared to younger pilots, sleep quantity and quality during the stopover night were sufficient to made them recover, and to perform at an adequate level on the return flight.
Author

Age Factor; Alertness; Wakefulness; Pilot Performance; Flight Fatigue

20000105065 Department of the Air Force, School of Aerospace Medicine, Brooks AFB, TX USA
SPINAL DISEASE IN AVIATORS AND ITS RELATIONSHIP TO G-EXPOSURE, AGE, AIRCRAFT SEATING ANGLE, EXERCISE AND OTHER LIFESTYLE FACTORS
Drew, William Edward Dougherty, Sr., Department of the Air Force, USA; Operational Issues of Aging Crewmembers; August 2000, pp. 6-1 - 6-9; In English; See also 20000105060; Copyright Waived; Avail: CASI; A02, Hardcopy

Repetitive G-exposures during high-performance (HP) flying have a potential to accelerate the progression of degenerative spinal disease in aviators so exposed. Critical in determining the significance of these G-exposures is the selection of a control group as similar as possible in all other respects to the HP aviators studied.
Author

Spine; Diseases; Aircraft Pilots

20000105066 Aeromedical Inst., Dept. of Research and Development, Soesterberg, Netherlands
DEGENERATIVE CHANGES OF THE SPINE OF PILOTS OF THE RNLAF
Hendriksen, Ingrid J. M., Aeromedical Inst., Netherlands; Holewijn, Michael, Aeromedical Inst., Netherlands; Operational Issues of Aging Crewmembers; August 2000, pp. 7-1 - 7-11; In English; See also 20000105060; Copyright Waived; Avail: CASI; A03, Hardcopy

During air combat maneuvering under high +G(sub z) forces, the spine is frequently exposed to heavy loads. Therefore, acute in-flight neck injury is a common complaint among pilots flying high performance aircraft. However, not only sudden incapacitation is caused by high performance flying. The frequent and extreme loading of the spine over the years also constitutes a 'chronic' strain, which can possibly lead to degenerative changes. In the 'normal' population, the prevalence of spinal degeneration is associated with increasing age. However, this deterioration with age may be accelerated by regular exposure to high +G(sub z) forces. The aim of this study was to examine whether F-16 pilots are at an increased risk of (cervical) spine degeneration.
Derived from text

Spine; Degeneration; Deterioration; Back Injuries; Risk

20000105067 Gulhane Military Medical Academy Hospital, Ankara, Turkey
ECG FINDINGS DURING CENTRIFUGE TRAINING IN DIFFERENT AGE GROUPS OF TURKISH AIR FORCE PILOTS
Alan, M., Gulhane Military Medical Academy Hospital, Turkey; Akin, A., Gulhane Military Medical Academy Hospital, Turkey; Ozkan, M., Gulhane Military Medical Academy Hospital, Turkey; Savasan, M. K., Gulhane Military Medical Academy Hospital, Turkey; Operational Issues of Aging Crewmembers; August 2000, pp. 9-1 - 9-4; In English; See also 20000105060; Copyright Waived; Avail: CASI; A01, Hardcopy

One of the important reasons for starting centrifuge training was that G-LOC was found to have an increasing role in aircraft accidents. Turkish Aerospace Medical Center began high sustained G (HSG) centrifuge training for jet pilots in 199 1. ECG monitoring has been done from the beginning, but ECG data was collected for further research for only the last 2 years. Cardiac dysrhythmias occurring during centrifuge training, which are physiologic responses to high acceleration, have been reported by many investigators. Sekiguguchi et al. found that over 50% of pilots from the Japanese Air Self Defense Force had dysrhythmias during high G training. Whinnery has reported that treadmill stress testing and exposure to +G(sub z) forces produce a comparable incidence of dysrhythmias, but that G forces have a tendency to produce more serious dysrhythmias, such as ventricular tachycardia. These dysrhythmias usually are asymptomatic and resolve rapidly when the subjects return to 1-G environment. In this study we analyzed the ECG abnormalities occurring during centrifuge training.
Derived from text

Centrifuging Stress; Acceleration Tolerance; Gravitational Physiology; Physiological Responses

20000105068 Army Air Corps, Army Aviation, Stockbridge, UK
TERRITORIAL ARMY AIRCREW: 'THE SENIOR PILOTS' ARE THEY AT GREATER RISK?
Braithwaite, Malcolm G., Army Air Corps, UK; Operational Issues of Aging Crewmembers; August 2000, pp. 10-1 - 10-10; In English; See also 20000105060; Copyright Waived; Avail: CASI; A02, Hardcopy

This paper presents evidence of the operational effects of ageing on British Army aircrew in two areas: a restriction on flying (and other military duties) and accidents due to human factors. The data suggest that the age of Army pilots should not be reduced for

operational reasons. There is an underlying trend that, given that pilots with serious medical problems will tend to self-select themselves out of the service reasonably early, the more experienced aviator is both safer in flight and a lesser burden to himself, and the medical services.
Author
Aircraft Pilots; Flight Crews; Age Factor

20000105069 Centro de Instruccion de Medicina Aeroespatial, Preventive Medicine Dept., Madrid, Spain
AGE FACTOR RELATED TO HYPOXIA TOLERANCE
Lopez, J., Centro de Instruccion de Medicina Aeroespatial, Spain; Vallejo, P., Centro de Instruccion de Medicina Aeroespatial, Spain; Rios, F., Centro de Instruccion de Medicina Aeroespatial, Spain; Jimenez, R., Centro de Instruccion de Medicina Aeroespatial, Spain; delValle, J. B., Centro de Instruccion de Medicina Aeroespatial, Spain; Garcia-Alcon, J. L., Centro de Instruccion de Medicina Aeroespatial, Spain; Operational Issues of Aging Crewmembers; August 2000, pp. 11-1 - 11-6; In English; See also 20000105060; Copyright Waived; Avail: CASI; A02, Hardcopy

Hypoxia is one of the biggest challenges that we are facing. We define hypoxia as the absence of adequate supply of oxygen to the tissues. Humans are extremely sensitive and vulnerable to the effects of oxygen deprivation and severe hypoxia can cause a deterioration of the body's functions quickly, even death. According to the ethiology we distinguish four types of hypoxia: Hypoxic Hypoxia is due to a reduction of the arterial blood oxygen, Anaemic Hypoxia is due to the reduction in the oxygen-carrying capacity of the blood, Ischaemic Hypoxia is the result of the decrease of the sanguine flow in the tissues and Histotoxic Hypoxia is the result of an interference with the ability of the tissues to utilize a normal oxygen supply for oxidative processes.
Derived from text
Age Factor; Hypoxia; Oxygen Consumption; Deprivation

20000105070 Portuguese Air Force Aeromedical Center, Lisbon, Portugal
TIME OF USEFUL CONSCIOUSNESS IN CREWMEMBERS DURING HYPOBARIC CHAMBER FLIGHTS
Ribeiro, Numo, Portuguese Air Force Aeromedical Center, Portugal; Rocha, Carlos, Portuguese Air Force Aeromedical Center, Portugal; Alves, Joaquim, Portuguese Air Force Aeromedical Center, Portugal; Operational Issues of Aging Crewmembers; August 2000, pp. 12-1; In English; See also 20000105060; Copyright Waived; Avail: CASI; A01, Hardcopy

The authors studied the times of hypoxia in 43 Portuguese Air Force military people, during hypobaric training chamber flights. The times where measured since the moment the trainees took off the oxygen mask until they began to breath again 100% oxygen, this time being considered as the time of useful consciousness. The hypobaric chamber flights take place during the basic and refreshment physiological training courses of our crewmembers, according STANAG 3114.
Derived from text
Consciousness; Flight Crews; Hypoxia; Oxygen Consumption

20000105071 Unidad de Investigacion Subacuatica, Centro de Buceo de la Armada, Murcia, Spain
PULMONARY FUNCTION IN A DIVING POPULATION AGED OVER 40 YEARS OLD: A CROSS-SECTIONAL STUDY
Olea, A., Unidad de Investigacion Subacuatica, Spain; Gonzalez, J. D., Unidad de Investigacion Subacuatica, Spain; Arance, I., Unidad de Investigacion Subacuatica, Spain; Pujante, A., Unidad de Investigacion Subacuatica, Spain; Viqueira, A., Unidad de Investigacion Subacuatica, Spain; Operational Issues of Aging Crewmembers; August 2000, pp. 13-1 - 13-4; In English; See also 20000105060; Copyright Waived; Avail: CASI; A02, Hardcopy

Professional military divers are exposed to high pressure levels for a long time. This high pressure is going to have an effect on the diver and on the respiratory mixture that he is going to breath. The consequences of this high pressure level are the following: High oxygen partial pressure, an increase in the density of the mixture that will be proportional to the depth. All these different aspects can produce modifications in the pulmonary volume and flows that can be observed by sypirometric test.
Author
Pulmonary Functions; Lungs; Spirometers; Diving (Underwater); Underwater Tests; Human Tolerances

20000105073 Dundee Univ., School of Social and Health Sciences, UK
WORKING MEMORY, AGE, CREW DOWNSIZING, SYSTEM DESIGN AND TRAINING
Cook, Malcolm J., Dundee Univ., UK; Operational Issues of Aging Crewmembers; August 2000, pp. 15-1 - 15-13; In English; See also 20000105060; Copyright Waived; Avail: CASI; A03, Hardcopy

Working memory is a central component of many models of cognitive function and workload (c.f. Baddeley and Gathercole, 1993). The ability to store information on a short-term basis for rapid retrieval or to retain cues to aid recall of long-term information is often presented as a major bottleneck in human performance. Some models of human information processing (Pashler, 1998) place the bottleneck in the central processing phase between input and output and relate it to sequential processing, response selection or limited capacity processing, via a central executive. Many models of attention place the bottleneck between early in stimulus processing (Broadbent, 1957) or at both early and late stimulus processing (Norman, 1968). Wherever the bottleneck exists, or if its position varies with processing experience or attentional states, there has been a general consensus that the central processing phase is of limited capacity (Broadbent, 1958), from the very earliest work. This short term processing and storage capacity will be called working memory as termed by Baddeley and Hitch (1974). Working memory deals with memory processes and storage held in a quickly accessible store in preparation for processing or during the processing of information, where the store has limited or finite capacity'. Analyses of accidents in safety critical systems suggest that memory lapses are an important source of errors and serve to create fertile conditions for accident development (Redmill and Rajan, 1997).
Derived from text
Memory; Education; Learning; Retention (Psychology); Age Factor; Workloads (Psychophysiology)

20000105074 Etat-Major de la Marine, Antenne Programmes, Toulon, France
EVALUATION OF THE RISK OF AGE IN THE NAVY *[PRISE DE RISQUE ET VIEILLISSEMENT DANS LA MARINE]*
Sicard, Bruno, Etat-Major de la Marine, France; Jouve, Elisabeth, Centre Hospitalier Univ. La Timone, France; Couderc, Helene, Centre Hospitalier Univ. La Timone, France; Blin, Olivier, Centre Hospitalier Univ. La Timone, France; Operational Issues of Aging Crewmembers; August 2000, pp. 16-1 - 16-4; In French; See also 20000105060; Copyright Waived; Avail: CASI; A01, Hardcopy

As human age, decrements of performance may be observed. Efficiency in human/machine interaction is highly dependent on decision-making. Decision-making requires to compare, evaluate and manage risks, therefore, decision-making and risk proneness are related. The purpose of this study is to evaluate the effects of naval crew aging on risk proneness. We tested 130 male navy personnel, age range 19-41 years, with EVAR, a visual analogue scale designed to rate risk proneness. EVAR is composed of 24 items distributed among 5 factors: F1 'self control', F2 'danger-seeking', F3 'energy', F4 'impulsiveness' and F5 'invincibility'. When looking at other human factor studies. F1, F4 and F5 are the more relevant factors to safety issues. We observed a significant negative correlation between F3 'energy' and aging, whereas the other factors were not influenced by age. These results suggest that if navy crews are going to age moderately, within the 1941 years range, risk proneness change is limited and should not be a safety issue in decisionmaking process. Although the decrements in 'energy' observed with aging could lower the coping resource toward sleep deprivation and night shift, leading to new watch and rest schedule.
Author
Decision Making; Human Performance; Man Machine Systems

20000105076 Aeronautique Navale, Centre d'Expertise Medicale du Personnel Navigant, Toulon-Naval, France
PILOTS MEMORY AND PSYCHOMOTOR PERFORMANCE EVALUATION IN RELATION WITH AGE *[EVALUATION DES*

PERFORMANCES PSYCHOMOTRICES ET MNESIQUES DES PILOTES EN FONCTION DE L'AGE]

Taillemite, J. P., Aeronautique Navale, France; Desmants, F., Aeronautique Navale, France; Sicard, B., Aeronautique Navale, France; Niggel, R., Aeronautique Navale, France; Deroche, J., Aeronautique Navale, France; Courtiere, A., Aeronautique Navale, France; Menu, J. P., Aeronautique Navale, France; Operational Issues of Aging Crewmembers; August 2000, pp. 18-1 - 18-6; In French; See also 20000105060; Copyright Waived; Avail: CASI; A02, Hardcopy

Pilots Memory and Psychomotor Performance Evaluation in Relation with Age. Previous studies have shown an age related decrement in the performance of pilots tested in a flight simulator under intense attentional requirements. The purpose of this experiment was to evaluate the relationship between age and aviation related tasks on performance. We tested 31 military and 69 commercial pilots (including 34 former military pilots), age range 23 to 59 years, mean age 40 years old, on SEPIA, a motion based psychomotor evaluation device. SEPIA, similar to a flight simulator, is currently used to screen aviator candidates in the French Navy. A significant correlation was observed between age and psychomotor performance and working memory. Younger pilots tended to perform better than older ones. SEPIA scores were also affected by experience, assessed by total flight time and years of flying. When looking at the different age groups, simulator and memory performance decrements were statistically significant at age 41 and beyond: Type of training and experience, either for fighter, maritime patrol or commercial pilots, did not influence performance. Self graded analysis of simulator performance was in agreement with the real score and not age dependent. These tests did not allow us to evaluate flying skill of the participants, but only psychomotor capacity and adaptation to a new aeronautical environment. However, it is quite valid to take into consideration the age of the pilot when he transitions to another aircraft (after a first performance evaluation, naturally taking into account individual differences).

Author

Aircraft Pilots; Memory; Retention (Psychology); Psychomotor Performance; Pilot Performance

20000105077 Institute for Human Factors TNO, Dept. of Training and Instruction, Soesterberg, Netherlands

COGNITIVE AND SENSORY LIMITATIONS WITH AGING

Operational Issues of Aging Crewmembers; August 2000; 8p; In English; See also 20000105060; Copyright Waived; Avail: CASI; A02, Hardcopy

Demographic developments, characterized by 'ungreening' and 'greying' of the population at the same time, necessitate the reconsidering of early retirement schemes in general and possible those of military professionals as well. Keeping people in the services at older ages asks for continued training and education as the only way to keep people fit for the jobs and to prevent that their skills and knowledge become obsolete. Training and education has to be compatible with the sensory and cognitive changes with age as well the tasks and roles ageing people are best suited for. Changes in the sensory functions are undeniable: the eyes have lost their accommodation function at 60 and, due to yellowing of the eye-lens, discrimination of color differences in the blue part of the spectrum is no longer possible. Compared to young people only a third of the energy reaches the retina in older subjects. These kinds of sensory deterioration start already at the age of about twenty and similar patterns can be shown for the auditory and vestibular functions. For cognitive functions a somewhat more differentiated pattern has to be sketched with a lower functioning of working memory but no deterioration or even increasing functionality of the semantic memory and a still growing domain expertise. Despite functional changes, in general no performance decrement in actual work is found. This can be explained in several ways. One is that older people compensate for their reduced capabilities by using different task strategies. This may result in a different pattern of underlying skills used in doing the job. Based on rather scarce research results, especially scarce for the functioning of age, still a number of recommendations for designing training and education for the older professional can be formulated. They derive partly from the sensory degradations with age, partly from the field of adult education. Findings in the latter field can be traced back to the changes in cognitive functioning with age. The challenge, society at large but also the military face, is to make best use of a by necessity growing segment of older professionals, in such a way that also after retirement the older professionals are better prepared for a longer, more independent and active life.

Author

Cognitive Psychology; Cognition; Information Processing (Biology); Mental Performance; Psychomotor Performance; Sensory Perception

20000105079 Royal Defence Medical Coll., Military Medicine, Gosport, UK

ANTHRAX IMMUNIZATION IN THE OLDER WARRIOR

World, M. J., Royal Defence Medical Coll., UK; Operational Issues of Aging Crewmembers; August 2000, pp. 22-1 - 22-7; In English; See also 20000105060; Copyright Waived; Avail: CASI; A02, Hardcopy

When a higher than expected prevalence of adverse reaction was apparent following the first immunization, it was decided to monitor acceptance, adverse reactions, incapacity and antibody responses in 129 mainly caucasian members of a military field hospital during a voluntary programme of anthrax immunization at 0, 3, 6 and 24 weeks. Attempts were made to relate these variables to age. It was found that older warriors were at least as likely as younger colleagues to complete a voluntary anthrax immunization programme. They did not report adverse reactions more frequently at any stage but if an adverse reaction did occur following the first immunization, significant incapacity (inability to lift or to drive) lasting 48 hours in the majority occurred more frequently. There was no evidence that increasing age resulted in a diminished antibody response to anthrax immunization. The only penalty related to age appeared to be the higher prevalence of incapacity if adverse reaction followed the first anthrax immunization. This could be particularly critical in certain more vulnerable military populations such as aviators if a substantial proportion of personnel were over the age of 30 years and were possibly immune but were considered to require an urgent program of anthrax immunization before deployment.

Author

Infectious Diseases; Immunity; Immunology; Antibodies

20000105080 Universidad Complutense, School of Medicine, Madrid, Spain

GROWTH HORMONE AND AGING

Romero, Perez, Universidad Complutense, Spain; delasHeras, N., Universidad Complutense, Spain; Vasquez, S., Universidad Complutense, Spain; Ariznavarreta, C., Universidad Complutense, Spain; Operational Issues of Aging Crewmembers; August 2000, pp. 23-1 - 23-5; In English; See also 20000105060

Contract(s)/Grant(s): CAM08.4/0014/98; Copyright Waived; Avail: CASI; A02, Hardcopy

Growth hormone (GH) is a peptide containing 191 amino acids that is secreted by the acidofilic cells of the pituitary and has a very important action on growth during infancy and adolescence (Devesa et al 1996). To perform this action GH needs the collaboration of a full series of factors such as, thyroid hormones and sexual hormones together with an appropriate nutrition. GH is under the hypothalamic control of two peptides, one stimulating, GHRH firstly discovered in 1.982 (Guillemin et al 1982, Rivier et al 1982), and another inhibitory, somatostatin, that is a tetradecapeptide, discovered in 1973 by Brazeau et al (1973). Interaction between GHRH and somatostatin plays a significant role in the secretion of GH and somatostatin seems to play the major role (Devesa and Tresguerres 1996). GHRH is secreted in peaks as well as somatostatin, both with 180 deg shift, so that the GH peak appears when GHRH levels arc high, and somatostatin levels are low. GH disappears from blood when somatostatin values are high in the hypothalamus and GHRH is low (Tanenbaun and Link 1983). This control is exerted so that GH is secreted every 3h approximately, with higher amplitude during the night, actually during slow wave sleep. Some of the actions of GH are exerted through an intermediary product, IGFI, that it is synthetized in the liver and in other tissues under the estimulation of GH (Tresguerres 1996) IGFI is a peptide of 70 amino acids that shows similarities with proinsulin and acts on a paracrine way on the growth plates of the long bones stimulating the multiplication of chondrocites and determining growth. IGF I generated in the liver under GH stimulation circulates in the blood bound to a series of transport proteins called IGF BPS that are also GH dependent, especially IGFBP 3. However the most important role is exerted by this a

peptide, when synthesized locally in a paracrine way (Tresguerres1996).
Derived from text
Hormones; Peptides; Amino Acids; Aging (Biology); Growth; Biological Evolution

20000105081 Institut de Medicine Aerospatiale Armee, Departement de Physiologie Aerospatiale, Bretigny sur Orge, France
ENDOCRINE RESPONSE TO TRAINING PROGRAMS IN THE MIDLIFE
Operational Issues of Aging Crewmembers; August 2000, pp. 24-1 - 24-11; In English; See also 20000105060; Copyright Waived; Avail: CASI; A03, Hardcopy

It has been proposed that regular physical exercise training could delay the normal process of aging and protect against the metabolic disorders of midlife. In order to relate the hormonal response to training and its protective effects, the recent theory on aging are firstly exposed. The role of hormonal changes on aging process is evoked. In the second part, the normal hormonal response to physical exercise and training, are exposed. In the last part, the specificity of hormonal response to training in midlife is used to explain some protective effect of training. The principal effect seem the improvement in insulin sensitivity but the role of training on growth hormone and androgen could be involved in the effect of training on muscle mass and bone density.
Author
Physical Exercise; Aging (Biology); Endocrinology; Endocrine Systems

20000105082 National Center of Hygiene, Medical Ecology and Nutrition, Sofia, Bulgaria
AGE EFFECT ON AUTONOMIC CARDIOVASCULAR CONTROL IN PILOTS
Nikolova, R., National Center of Hygiene, Medical Ecology and Nutrition, Bulgaria; Danev, S., National Center of Hygiene, Medical Ecology and Nutrition, Bulgaria; Nantcheva, R., Military Medical Academy, Bulgaria; Vukov, M., National Center of Health Informatics, Bulgaria; Operational Issues of Aging Crewmembers; August 2000, pp. 25-1 - 25-11; In English; See also 20000105060; Copyright Waived; Avail: CASI; A03, Hardcopy

The autonomic cardiovascular control was determined as a function of age in 66 military pilots and in 39 referents, both groups aged from 20 to 55 yr. It was assessed by time-domain and frequency-domain heart rate variability (HRV) measures and with some HRV derived indices. Most sensitive to aging process from time-domain HRV measures revealed to be short-term variability and time-domain index, and from frequency-domain HRV measures frequency-domain index. The activity of both ANS branches was found to decline with age, but a different extent of decrease of sympathetic as compared to parasympathetic activity was observed: sympathetic activity reflected by the spectral power of the R-R intervals in the temperature mediated spectral frequency band (0.01-0.05 Hz) decline more slowly than parasympathetic activity reflected by respiratory sinus arrhythmia - mediated spectral frequency band (0.15-0.50 Hz). As well as such age-desynchronized autonomic cardiovascular control was found only in military pilots but not in referents it is concluded that the aging process in pilots is accelerated due to repetitive and prolonged exposure to persisting stress, caused by the compulsory underload (substantial reduction of flying tasks and physical exercises coinciding with personal interviews). Although the computed Overall Health Risk values in both groups were not substantially deviated from 'normal', those in military pilots was significantly higher.
Author
Age Factor; Autonomic Nervous System; Cardiovascular System; Aircraft Pilots

20000105083 Stathogiannis (Evangelos), Athens, Greece
THE ASSOCIATION BETWEEN AGING AND BIOCHEMICAL-METABOLICAL INDEXES IN A RANDOM PERSONNEL SAMPLE OF HELLENIC AIR FORCE
Stathogiannis, Evangelos, Stathogiannis (Evangelos), Greece; Andrikopoulos, George, Ippokrateion General Hospital, Greece; Dounis, Basilios; Markou, Joannis; Operational Issues of Aging Crewmembers; August 2000, pp. 26-1 - 26-18; In English; See also 20000105060; Copyright Waived; Avail: CASI; A03, Hardcopy

The prolonged military operational stresses and the increased life expectancy may induce the appearance of several metabolic and cardiovascular disorders. The early diagnosis of these disorders could contribute to their prevention and effective management. This study is a part of a long-term prospective investigation of association between aging and biochemical-metabolical indexes.
Derived from text
Aging (Biology); Biochemistry; Metabolism; Cardiovascular System; Military Operations; Flight Stress (Biology)

20000105084 Institute of Aviation Medicine, Dept. of Functional Diagnostics and Clinical Physiology, Prague, Czechoslovakia
DOES AGING OR ENDOTHELIAL DYSFUNCTION POSE A THREAT TO MILITARY CREWMEMBERS?
Rada, M. A., Institute of Aviation Medicine, Czechoslovakia; Operational Issues of Aging Crewmembers; August 2000, pp. 27-1 - 27-11; In English; See also 20000105060; Copyright Waived; Avail: CASI; A03, Hardcopy

Aging is a physiologic process associated with an increase of health conditions limiting somewhat an aviator's performance abilities generally. What is more, vascular aging is closely linked with an increase in cardiovascular morbidity and mortality. This may be related to cellular changes due to an increased oxidative stress or/and to an impaired release of vasoactive mediators by endothelium cells. Endothelium-dependent relaxation decreases with aging. Consequent cardiovascular changes and damages with or without the presence of other risk factors and bad life style habits may speed up that process. This may lead to clinical manifestation of the disease, grounding, treatment and even to a permanent disqualification from flying duty not surprisingly within the third and fourth decade. Besides aging, which is an independent risk factor per se, there are new scientific discoveries which have refined our understanding of the endothelium dysfunction process complexity. Additionally, it has been proven that some medicaments like HMG-CoA reductase inhibitors, ACE inhibitors and Ca antagonists, particularly those with a long duration of action, improve endothelium function of the coronary circulation in patients with atherosclerosis or hypertension along with an appropriate physical activity, smoking cessation, glucose intake restriction etc. The content of this paper is focused on highlighting new aspects of aging, links between them, mechanisms of action and interaction. The whole process should be seen as a complex of mechanical, humoral, nutritious, metabolic, endocrine and exogenous factors interplay, having a deleterious impact on human health status, crewmembers including. The end-stage occurs more earlier then simply in the course of natural aging process. Better understanding of these facts was contrasted with clinical findings among the group of Czech military aviators primarily treated for hypertension, as well as for hyperlipidemia and hyperuricemia over the past five years. We succeeded in good control of hypertension pharmacologically, but we failed with influencing of other discovered risk factors. No wonder, that prior to ending up this study, three aviators were disqualified for flying duty due to coronary artery disease (CAD) development. Based on comparison of known experimental facts, clinical trial outcomes and our findings, we have tried to formulate possible pathways for changing our minds and defined particular steps in order to reverse the unwanted trends reached so far in the management of cardiovascular diseases. These steps consist of non-pharmacological and pharmacological interventions in crewmembers. The answer to the question at the beginning will be more elucidated and sophisticated steps then formulated at the end of this paper.
Author
Aging (Biology); Cells (Biology); Risk; Armed Forces; Aircraft Pilots; Pilot Performance; Operator Performance

20000105085 Portuguese Air Force Aeromedical Center, Lisbon, Portugal
STUDY OF CARDIOVASCULAR RISK FACTORS AND AGE-RELATED CHANGES IN VISUAL ACUITY IN PORTUGUESE AIR FORCE PILOTS *[ETUDE DES FACTEURS DE RISQUE CARDIOVASCULAIRE ET DES CHANGEMENTS DE L'ACUITE VISUELLE DUS AU VIEILLISSEMENT: CHEZ LES PILOTES DE L'ARMEE DE L'AIR PORTUGAISE]*
Ribeiro, Nuno, Portuguese Air Force Aeromedical Center, Portugal; Correia, Rui, Portuguese Air Force Aeromedical Center, Portugal; Silveira, Simao, Portuguese Air Force Aeromedical Center, Portugal; Laureano, Fatima, Portuguese Air Force Aeromedical Center,

Portugal; dosSantos, Climaco, Portuguese Air Force Aeromedical Center, Portugal; Operational Issues of Aging Crewmembers; August 2000, pp. 30-1 - 30-3; In French; See also 20000105060; Copyright Waived; Avail: CASI; A01, Hardcopy

This work in an attempt to find links between the aging of pilots and a few parameters usually collected in the course of yearly medical fitness tests given in the Aeronautical Medical Center of the Portuguese Air Force (FAP).
Derived from text
Cardiovascular System; Risk; Age Factor; Visual Acuity

20000105086 Department of the Air Force, Aerospace Ophthalmology Branch, Brooks AFB, TX USA
OCULAR PROBLEMS OF THE AGING MILITARY AVIATOR
Tredici, T. J., Department of the Air Force, USA; Ivan, J., Department of the Air Force, USA; Operational Issues of Aging Crewmembers; August 2000, pp. 32-1 - 32-4; In English; See also 20000105060; Copyright Waived; Avail: CASI; A01, Hardcopy

Approximately 20% of all the USAF aviators are now over the age of 40. Over 60% of the U.S. civilian airline pilots are over the age of 40. Because of the age 60 rule, these pilots must retire when they reach 60 years of age. We decided to look at what are the ocular/visual problems that brought our senior USAF aviators to the Consultation Service at the USAF School of Aerospace Medicine at Brooks AFB, Texas. The Consultation Service evaluates all USAF aviators who have a medical problem that threatens their flight status. Following a through medical workup, our staff makes a recommendation to the USAF Surgeon Generals' Office. This might be grounding, further treatment, a waiver to return to flight status or change in flight status.
Derived from text
Visual Perception; Visual Acuity; Vision; Eye (Anatomy); Age Factor; Aging (Biology)

20000105087 Department of the Air Force, School of Aerospace Medicine, Brooks AFB, TX USA
INTRAOCULAR LENSES IN MILITARY AIRCREW
Ivan, Douglas J., Department of the Air Force, USA; Tredici, Thomas J., Department of the Air Force, USA; Operational Issues of Aging Crewmembers; August 2000, pp. 33-1 - 33-7; In English; See also 20000105060; Copyright Waived; Avail: CASI; A02, Hardcopy

Modern advances in microsurgical procedures performed on the human eye distinctly stand out as one of the most, if not the most, dramatic advances in medical sciences over the last 75 years. Cataract surgery has emerged as one of the most common surgical procedures regardless of surgical subspecialty. Although attempts to 'surgically' remove cataractous lenses can literally be traced back for thousands of years, visual rehabilitation postoperatively would not reach its zenith until development of the intraocular lens (IOL).
Derived from text
Eye (Anatomy); Lenses; Cataracts; Surgery

20000105088 Army Aeromedical Research Lab., Fort Rucker, AL USA
VISUAL PERFORMANCE ON THE SMALL LETTER CONTRAST TEST: EFFECTS OF AGING, LOW LUMINANCE AND REFRACTIVE ERROR
vandePol, Corina, Army Aeromedical Research Lab., USA; Rabin, Jeff, Army Aeromedical Research Lab., USA; Operational Issues of Aging Crewmembers; August 2000, pp. 34-1 - 34-5; In English; See also 20000105060; Copyright Waived; Avail: CASI; A02, Hardcopy

In this study the visual performance of aviators and a myopic, non-aviator group were compared to determine the effects of aging, available light and refractive error. The chart used is a novel chart called the Small Letter Contrast Test (SLCT) which measures sensitivity to contrast at the moderate to high end of the spatial frequency range near the visual acuity thresholds of most normal observers. All three variables influence visual performance on the SLCT, age having a greater effect on low luminance performance and refractive error having comparable effects on SLCT performance regardless of luminance level. High contrast visual acuity remains fairly stable and normal over the age range tested; however it decreases with increasing refractive error.
Author
Visual Perception; Visual Observation; Aircraft Pilots

20010002525 Defence Evaluation Research Agency, Centre for Human Sciences, Farnborough, UK
TRAINING MINIMAL ACCESS SURGERY SKILLS WITHIN A VIRTUAL ENVIRONMENT
Kelly, M., Defence Evaluation Research Agency, UK; The Capability of Virtual Reality to Meet Military Requirements; November 2000, pp. 3-1 - 3-5; In English; See also 20010002522; Copyright Waived; Avail: CASI; A01, Hardcopy

A training system for Minimal Access Surgery (MAS) has been developed by the Centre for Human Sciences, part of the Defence and Evaluation Research Agency. The system consists of an object model database which can be interacted with via simulated MAS surgical tools. It is based on two low cost networked personal computers and linked to a pair of laparoscopic tools to provide accurate force feedback within a virtual environment. Development of an integrated training system forms a necessary part of delivering an effective training tool. A hierarchical task analysis (HTA) has been used to determine the key skills demanded of the surgeon in laparoscopic ectopic pregnancy. The experimental evaluation of system features to enable cost benefit trade offs to be made is discussed. From the HTA and a review of the literature new conclusions about the fundamental nature of the tasks to be trained in MAS are presented. The conclusion that adaptation to a continually varying control law is the fundamental task to be trained in MAS has implications for the design of MAS training systems. A future programme of experimental trials work on the simulator design parameters of force feedback, scene detail and 3-D, and the application of Distributed Interactive Simulation (DIS) networks, being carried out in conjunction with the Surrey RCS MATTU unit and Loughborough University is discussed.
Author
Training Simulators; Virtual Reality; Education; Medical Electronics; Telemedicine; Distributed Interactive Simulation

20010002531 Optics 1, Inc., Westlake Village, CA USA
METHODS FOR IMPROVING DEPTH PERCEPTION IN HMDS
Fischer, Robert E., Optics 1, Inc., USA; Reiley, Daniel J., Optics 1, Inc., USA; Pope, Charles, Naval Air Warfare Center, USA; Peli, Eli, Harvard Medical School, USA; The Capability of Virtual Reality to Meet Military Requirements; November 2000, pp. 9-1 - 9-8; In English; See also 20010002522; Original contains coloe illustrations Contract(s)/Grant(s): N61339-97-C-0059; Copyright Waived; Avail: CASI; A02, Hardcopy

Head mounted display systems typically present imagery to the user focused either at infinity (collimated light into the eyes), or alternatively at some nominal finite distance in the order of 11 - 18 feet (diverging light into the eyes). When the imagery presented by an HMD is focused at a finite distance, the right and left eyes are sometimes intentionally set to converge to that same distance. Alternatively, the eyes are often left viewing parallel to one another. In some HMDs the user is permitted to select his or her own preferred focus distance. There appears to be an advantage in improving depth perception in an HMD simulation environment by altering in real time the focus or apparent object distance to match the distance of the principal object or objects being viewed at that time by the user. An eye tracker may be employed to determine where in the scene the user is looking, and the data is fed back to the computer to perform, as appropriate, the refocusing task based on the known distance of the object being looked at. Further realism improvement is likely by changing the convergence as well. This paper will discuss the relative merits of altering the accommodation and convergence as well as the means for accomplishing the refocusing task in the HMD viewing optics rapidly, in real time, and without otherwise altering the image quality or magnification. The net goal is to improve the overall realism of the simulation to the user.
Author
Space Perception; Helmet Mounted Displays; Image Resolution; Magnification; Image Analysis; Image Enhancement; Imaging Techniques

20010002533 Brandeis Univ., Ashton Graybiel Spatial Orientation Lab., Waltham, MA USA
MOTION SICKNESS SIDE EFFECTS AND AFTEREFFECTS OF IMMERSIVE VIRTUAL ENVIRONMENTS CREATED WITH HELMET-MOUNTED VISUAL DISPLAYS
DiZio, Paul, Brandeis Univ., USA; Lackner, James R., Brandeis Univ., USA; The Capability of Virtual Reality to Meet Military

Requirements; November 2000, pp. 11-1 - 11-4; In English; See also 20010002522
Contract(s)/Grant(s): N61339-96-C-0026; Copyright Waived; Avail: CASI; A01, Hardcopy

We have investigated side effects and aftereffects evoked by moving the head to interact with a virtual environment (VE) shown in a helmet mounted visual display (HMD). The graphics computer of such a VE must monitor the HMD's spatial orientation and position in order to present images from the proper perspective. Delays between head movements and image updating cause aberrant visual motion of a virtual world. We found that above delays of 40 ms motion sickness and postural instability are evoked minutes after head movements begin. The severity of side effects is a function of the latency between head movement and visual update delay. Fifteen minutes of making head movements in a VE with a 254 ms delay causes motion sickness severe enough to make 28% of subjects withdraw from the situation. Users appear recovered 15 minutes after VE exposure ends if they remain immobile, but normal activities quickly revive their motion sickness symptoms, indicating that they were sensitized by exposure to visual update delays. We conclude that visual update delays are a unique cause of side effects and aftereffects in VEs utilizing HMDs.
Author
Motion Sickness; Head Movement; Signs And Symptoms

20010032430 Norwegian Defence Research Establishment, Kjeller, Norway
ENDOCRINE AND METABOLIC CHANGES DURING EXHAUSTIVE MULTIFACTORIAL MILITARY STRESS. RESULTS FROM STUDIES DURING THE RANGER TRAINING COURSE OF THE NORWEGIAN MILITARY ACADEMY
Opstad, P. K., Norwegian Defence Research Establishment, Norway; The Effect of Prolonged Military Activities in Man. Physiological and Biochemical Changes. Possible Means of Rapid Recuperation; March 2001, pp. 1-1 - 1-30; In English; See also 20010032429; Copyright Waived; Avail: CASI; A03, Hardcopy

The endocrine and metabolic system is strongly affected by stress and its regulation is vital for both physical and mental performance particularly during physical stress, energy deficiency and sleep deprivation. In the present paper we have studied the endocrine and metabolic changes in male cadets from the Norwegian Military Academy during a strenuous military training course.
Author
Endocrine Systems; Exhausting; Mental Performance

20010032431 Norwegian Defence Research Establishment, Kjeller, Norway
THE PHAGOCYTE FUNCTION DURING MULTIFACTORIAL MILITARY STRESS, AND NEUROENDOCRINE INTERACTIONS WITH PHAGOCYTES
Wiik, P., Norwegian Defence Research Establishment, Norway; Opstad, P. K., Norwegian Defence Research Establishment, Norway; Boyum, A., Norwegian Defence Research Establishment, Norway; The Effect of Prolonged Military Activities in Man. Physiological and Biochemical Changes. Possible Means of Rapid Recuperation; March 2001, pp. 2-1 - 2-7; In English; See also 20010032429; Copyright Waived; Avail: CASI; A02, Hardcopy

The huminal-amplified chemiluminescence response of granulocytes to serum opsonized zymosan particles ex vivo, was investigated during a ranger training course lasting for 7 days with continuous strenuous physical activities, calorie and sleep deprivation. A priming for accentuated chemiluminescence response was observed during the first days the course with a maximum increase on Day 3 (+ 35 % of control levels). Thereafter, a reduction to below control values was observed, minimum value was observed on Day 7 (-28 %). One group (N = 8) receiving 6000 kJ/24 h of energy, showed a more pronounced priming during the first days compared to the other group receiving an average of 1000 kJ/24 h (maximum +57 % versus +21 %), and less reduction of the chemiluminescence compared to control on the following days. These data indicate that extreme physical activity for up to a few days primes the production of reactive oxygen species in granulocytes, while activity for a longer time results in a dowmmodulation.
Author
Cells (Biology); Endocrine Systems; Neurophysiology; Sleep Deprivation

20010032432 Norwegian Defence Research Establishment, Div. for Environmental Toxicology, Kjeller, Norway
THE EFFECT OF STRENUOUS EXERCISE, CALORIE DEFICIENCY AND SLEEP DEPRIVATION ON WHITE BLOOD CELLS, PLASMA IMMUNOGLOBULINS AND CYTOKINES
Boyum, A., Norwegian Defence Research Establishment, Norway; Wilk, P., Norwegian Defence Research Establishment, Norway; Gustavsson, E., Nycomed Pharma, Norway; Veiby, O. P., Nycomed Bioreg A.S., Norway; Reseland, J., Oslo Univ., Norway; Haugen, A. H., Norwegian Defence Research Establishment, Norway; Opstad, P. K., Norwegian Defence Research Establishment, Norway; The Effect of Prolonged Military Activities in Man. Physiological and Biochemical Changes. Possible Means of Rapid Recuperation; March 2001, pp. 3-1 - 3-14; In English; See also 20010032429; Copyright Waived; Avail: CASI; A03, Hardcopy

Moderate exercise appears to stimulate the immune system, but there is good evidence that intense exercise can cause immune deficiency. In the present study we examined the effect of continuous physical exercise (~35 % of VO2 max), calorie deficiency and sleep deprivation on the immune system of young men participating in a 5-7 days military training course. There was a 2-3 fold increase of neutrophils from day 1, the values remained high and decreased slightly at the end of the course. Monocyte counts also increased with a pattern similar to that of neutrophils. Eosinophils decreased to 30 % of control and lymphocyte numbers decreased by 30-40%. All the major subgroups (CD4 T cells, CD8 T cells, B cells, NK cells) were reduced. Neutrophil function, as tested by measuring chemotaxis, was significantly stimulated during the first days of the course, in particular in the group with the lowest calorie intake. The mitogenic response of lymphocytes to PHA and Con A was variable, ranging from stimulation during one course to no effect in another course. Serum levels of immunoglobulins decreased significantly during the course. IgG was reduced by 6-7%, IgA by 10-20% and IgM by 20-35%. We found no changes of interleukin 1, 2 and 4 during the course, but a (12-20%) reduction (p less than 0.01) of interleukin 6, and an increase (p less than 0.01) of granulocyte-macrophage colony stimulating factor. Altogether the results from the ranger course present a mixed-up picture. The non-specific phagocyte-related immunity was enhanced. On the other hand, our data indicate that even a moderate physical activity, around the clock, caused significant suppression of a number of parameters reflecting the status of the specific, lymphocyte-related immunity. Still, it is noteworthy that there was no significantly increased infection rate during the course or in the first 4-5 weeks thereafter.
Author
Sleep Deprivation; Serums; Physical Exercise; Leukocytes; Immune Systems; Human Beings; Eosinophils; Antibodies

20010032433 Austrian Army Hospital, Research Study Group on Physical Performance, Vienna, Austria
FLUID REGULATION AND TIME COURSE OF ERYTHROPOIETIN DURING MULTIFACTORIAL STRAIN OF AUSTRIAN SPECIAL FORCES SURVIVAL TRAINING
Gunga, H.-C., Freie Univ., Germany; Wittels, P., Austrian Army Hospital, Austria; Kanduth, B., Austrian Army Hospital, Austria; Kirsch, K., Freie Univ., Germany; The Effect of Prolonged Military Activities in Man. Physiological and Biochemical Changes. Possible Means of Rapid Recuperation; March 2001, pp. 4-1 - 4-13; In English; See also 20010032429; Copyright Waived; Avail: CASI; A03, Hardcopy

The aim of this study was to provide data on fluid-regulating mechanisms with special regard to the role of plasma proteins in the control of plasma volume (PV), and to investigate erythropoietin production and release during a period of prolonged multifactorial strain. 29 male subjects, with a mean age of 22.2 +/- 2.8 years, were studied during a 5 day lasting survival training including restricted water (11 H2O/ day) and food intake (628 kJ/ day) additionally to physical exercise and sleep deprivation (20 h within 5 days). Under field conditions heart rate was monitored continuously, and body mass, body composition and blood parameters were measured at (TI), after 72 h (T2), after 120 h (T3) and in the recovery period after 48 h (T4) and 72 h (T5). The estimated energy expenditure was approximately 24000 kJ/ day. The mean decrease of body mass was 6.77 kg (9.5%) at T3 (p less than 0.001). A reduction of total body water of 3.81 was estimated at T3. Serum creatinine ([Cr]) was raised at T3 by 18.5% (p mless than 0.0001). The PV decreased by 3.7% (p less than 0.0001) at T2, increased by 1.6% (p less than

0.0001) at T3 and was not different to baseline at T4 (+0.2%; n.s.). Plasma proteins shifted into the intravascular space at T2 and T3 and moved out of the intravascular space at T4 and T5. Our data provide evidence that this mechanism assists PV-homeostasis efficiently over a period of 120 h even under conditions with a fluid loss of almost 8% of the total body water. EPO controls at T1 were 15.2 +?- 8.8 mU/ml. EPO was decreased during the course (T2: 8.7 +/- 7.9 mU/ml; p less than 0.01 and T3: 11.6 +/- 6.7 mU/ml; p less than 0.01) and showed a significant increase in the recovery period. Serum iron increased from 13.5 +/- 4.5 micro mol./l at T1 to 24.5 +/- 4.1 micro mol/l at T2 (P less than 0.01) and decreased during recovery. Haptoglobin (HAPTO) decreased from 165.4 +/- 55.3 mg/d1 at T1 to 85.8 +/- 51.7 mg/dl at T3 (P less than 0.01). Thereafter HAPTO increased (T4 132.0 +/- 52.2 mg/dl, P less than 0.01) and remained below control level at T5 (131.6 +/- 58.3 mg/dl, P less than 0.01). Transferring decreased continuously from 303.3 +/- 65.3 mg//dl at T1 to 256.8 +/- 58.8 mg/dl at T5 (P less than 0.01). Ferritin increased from 70.2 +/- 50.2 ng/ml at T1 to and 150.1 +/- 60.2 at T3 (P less than 0.01) and returned to control level at T5 (85.7 +/- 44.8 ng/ml, P less than 0.01). [Hb] increased from T1 (15.3 +/- 0.7 g/dl) to T2 (16.6 +/- 0.7 g/dl, P less than 0.01) and decreased significantly thereafter (T5 14.6 +/- 0.6 g/dl, (P less than 0.01). Haernatocrit increased from 44.2 +/- 2.1 % T1 to 46.8 +/- 1.9 %, P less than 0.01) at T2 and remained afterwards below the control (T5 41.4 +/- 1.8 P less than 0.01). It seems that EPO production and release is diminished by nutritional factors, i.e. mainly caloric intake, during prolonged physical strain. In the recovery period a rapid EPO increase took place to normalise red cell mass. These data shade new light upon the changes of erythropoiesis in astronauts observed during and after space flight. Since astronauts also show body mass losses and decreased EPO levels in a similar range during and immediately after space flights the question arises whether this might be due to a lowered caloric and/or protein intake rather than an effect of micro-gravity per se.
Author
Blood; Body Fluids; Erythrocytes; Food Intake; Physical Exercise; Plasma Control; Survival

20010032434 Centre de Recherches du Service de Sante des Armees, Unite de la Physiologie de Vigilance Emile Parde, La Tronche, France
SLEEP RECOVERY FROM PHYSICAL EXERCISE: A NEW UNDERSTANDING OF BRAIN RESPONSES TO STRESS
Buguet, Alain, Centre de Recherches du Service de Sante des Armees, France; The Effect of Prolonged Military Activities in Man. Physiological and Biochemical Changes. Possible Means of Rapid Recuperation; March 2001, pp. 5-1 - 5-12; In English; See also 20010032429; Copyright Waived; Avail: CASI; A03, Hardcopy

The effects of physical exercise on human sleep (exercise in temperate conditions, in the cold and in hot climates) are analysed and discussed in comparison to studies on sedentary sleep in extreme environments (tropical and polar climates), and on sleep in rats after stressful events (sleep deprivation). An attempt to interpret the stress-induced sleep changes is developed, involving a 'central' response and a 'general' stress response. These responses ('diachronic' or 'synchronic') are also examined in relation to chronobiological mechanisms.
Author
Brain; Physical Exercise; Sleep Deprivation

20010032435 Army Research Inst. of Environmental Medicine, Natick, MA USA
ACUTE RECOVERY OF PHYSIOLOGICAL AND COGNITIVE FUNCTION IN US ARMY RANGER STUDENTS IN A MULTI-STRESSOR FIELD ENVIRONMENT
Friedl, Karl E., Army Research Inst. of Environmental Medicine, USA; Mays, Mary Z., Army Research Inst. of Environmental Medicine, USA; Kramer, Tim R., Department of Agriculture, USA; Shippee, Ronald L., Army Research Inst. of Environmental Medicine, USA; The Effect of Prolonged Military Activities in Man. Physiological and Biochemical Changes. Possible Means of Rapid Recuperation; March 2001, pp. 6-1 - 6-10; In English; See also 20010032429; Copyright Waived; Avail: CASI; A02, Hardcopy

The time course for soldier recovery and reentry to the battlefield following high intensity direct action missions is of importance to unit commanders and military planners. It also provides a critical background understanding for medical researchers investigating approaches to extend the limits of soldier physical and psychological endurance. This report summarizes findings for soldiers followed through two recovery periods, during and after, a prolonged exhaustive military activity, the U.S. Army Ranger course. Within the course, with a modest increase in sleep and energy intake for 7 days, the soldiers demonstrated recovery of some cognitive function (e.g., decoding and pattern analysis) and acute metabolic/stress markers (e.g., serum testosterone, IGF1, and triiodothyronine). More complex intellectual processes (e.g., reasoning), other biochemical indicators (e.g., hyperlipidemia, serum cortisol), and cell-mediated immune function (e.g., in vitro PHA-stimulated T-lymphocyte proliferation) demonstrated progressive changes in response to the cumulative stress and were unaffected by the partial cessation of stressors during the course. Five weeks after the course, all of these parameters demonstrated recovery, or even overshoot. These data illustrate the remarkable resilience of fit young soldiers and demonstrate that a brief period of increased sleep and feeding partially restores soldiers before reentry to combat.
Author
Biochemistry; Cytology; Exhausting; Lymphocytes; Physiology; Sleep

20010032436 Air Force Research Lab., Brooks AFB, TX USA
MANAGING FATIGUE IN LONG DURATION AIRLIFT OPERATIONS 1994
French, Jonathan, Air Force Research Lab., USA; The Effect of Prolonged Military Activities in Man. Physiological and Biochemical Changes. Possible Means of Rapid Recuperation; March 2001, pp. 7-1 - 7-9; In English; See also 20010032429; Copyright Waived; Avail: CASI; A02, Hardcopy

During September, 1994 the operational tempo for US Air Force C-5 transport crews was at a record high. Support flights were routinely sent to assist international efforts to bring peace to warring factions in Rwanda, Somalia and, in addition to their normal full time responsibilities, there were additional flights needed to reinstate the elected government in Haiti. I interviewed crews at Dover AFB to learn their perspectives of the sources and the extent of fatigue on these sustained missions. Many of these crews had participated in Operation Restore Hope II to Somalia which involved multiple 25 + hour flights from the US to Somalia before crew resting in Cairo. I learned the pace of C-5 operations has remained at record levels since the Gulf War. Important issues identified by the crews were cumulative sleep debt, circadian disruption and their impact on mission safety. I was able to accompany a crew throughout a planned 10 day support mission. This report is based on my conversations with about 35 officers and enlisted transport crews. I was impressed with the similarity of the comments for the primary sources of frustration and fatigue in the conduct of C-5 missions. These are described more fully in the report but some deserve highlighting here. Many felt that once they did something demanding, like 20-hour plus missions or the then unprecedented three aerial refueling needed in Somalia, it becomes expected, not the 'one time only effort' they were told. There is a strong feeling that there are too many crews on BRAVO alerts, perhaps unnecessarily and BRAVO alerts were too long. Many were convinced that better collaboration with schedulers and the Wing would provide more realistic mission schedules. Based on some objective data I collected, in-flight sleep on the C-5 may be less restful than previously thought. Analysis of the nutritional content available in the box meal were conducted and suggests good food is available but not often selected by crews. A decibel meter was used to sample sound frequencies at 6 locations on the C-5 and while louder than published in the C-5 operations manual, the Dash-1, is still within limits. Given that longer missions may be more frequent, noise limits may need to be reconsidered. It is my hope that this report will stimulate interest in a larger study of C-5 crew fatigue issues. Coping strategies for management of fatigue that are simple to follow and can be implemented in current operations are provided at the end of the report and were derived, in large part, from the experiences gained during this investigation. Dr French has left the USAF and is now a fatigue consultant for shift-work, jet lag and sustained duration operations.
Author
Acoustic Frequencies; Circadian Rhythms; Jet Lag; Position (Location); Sensory Feedback; Sleep

20010032437 Defence Research Agency, Centre for Human Sciences, Farnborough, UK
THE BIOCHEMICAL AND PHYSIOLOGICAL EFFECTS OF 95 DAYS ENDURANCE EXERCISE IN NEGATIVE ENERGY BALANCE
Stroud, M. A., Defence Research Agency, UK; The Effect of Prolonged Military Activities in Man. Physiological and Biochemical Changes. Possible Means of Rapid Recuperation; March 2001, pp. 8-1 - 8-9; In English; See also 20010032429; Copyright Waived; Avail: CASI; A02, Hardcopy

In times of war, men push themselves to physical limits well beyond those that are conventionally thought possible, and hence it is extremely difficult to predict the limits of endurance capabilities using laboratory based studies. Of course, studies can be performed examining military exercises, although motivation levels may not be maximal and it is perhaps better to study rigorous military selection processes, where intense competition maximizes the psychological drives. This approach has been utilized successfully by several groups. For shorter-term activities, it is also possible to study athletic performance which provides measures of sustainable levels of physical effort with some degree of military relevance, since athletes are very highly motivated. In the case of ultra-distance competitors, there is even the potential to assess physical performance and its decline over several days, and hence studies of these events should be encouraged in the context of furthering our understanding of exhaustive military Operations. However, when it comes to investigation of likely physical performance over very extended exhaustive activities, it becomes increasingly difficult to find potential study models which combine sustained physical work with the kind of motivation levels that would occur in potential life threatening wartime situations. It is in this context, that I believe that studies of prolonged Polar, or other expeditions can be of value. Polar expeditions provide an opportunity to examine the effects of extreme sustained exercise combined with relative under nutrition in an adverse environment. The participants are pushed to their physiological limits and hence the data gathered can provide unique information regarding survival and function under the very worst conditions. This paper describes studies performed in relation to the first unsupported crossing of Antarctica - studies conducted by the Army Personnel Research Establishment, UK, which is now incorporated into the DRA Centre for Human Sciences.
Author
Balance; Biochemistry; Exhausting; Human Beings; Physical Exercise; Physiological Effects; Personnel

20010041357 Research and Technology Organization, Human Factors and Medicine Panel, Neuilly-sur-Seine, France
OPERATIONAL COLOUR VISION IN THE MODERN AVIATION ENVIRONMENT *[LA VISION DES COULEURS DANS L'ENVIRONNEMENT AERONAUTIQUE OPERATIONNEL D'AUJOURD HUI]*
March 2001; 176p; In English
Report No.(s): RTO-TR-016; AC/323(HFM-012)TP/6; ISBN 92-837-1026-6; Copyright Waived; Avail: CASI; A09, Hardcopy; C01, CD-ROM

In the past, standards and procedures for the examination of colour vision were based on red, green and white colour signals, together with the beacons associated with traditional navigational aids, originally developed for maritime or rail transport and subsequently adapted to the aeronautical environment. Many of these systems are still in service today. The role of colour in the military environment has been considerably extended, with the whole of the spectrum sometimes being used, rather than just a few limited colours. The visual requirements associated with this proliferation of colours call into question not only operational or ergonomical colour choices but also the procedures used to test professional colour sense. This can no longer be based solely on red, green and white discrimination or on screening for congenital masculine defective colour vision. Colour deficiencies of various origins are frequent and affect men and women to an equal extent. They affect both red and green vision and blue and yellow vision, which can be problematic when using modern day electronic displays. Finally, multiple filters can be placed between the outside world and the operator's eyes so as to protect him from high intensity light, lasers etc. These protective devices can themselves cause modification of colour vision, thereby interfering with the task to be carried out. What, then, is the latest data available on colour perception? How, and with what equipment or procedures can we test professional colour sense rather than colour vision anomalies? These two questions illustrate in part the purpose of the explanations and the scientific and technical bases provided in this document.
Author
Color; Color Vision; Human Factors Engineering

20010056518 Institute of Aviation Medicine, Koenigsbrueck, Germany
PHYSIOLOGICAL CONSEQUENCES: CARDIOPULMONARY, VESTIBULAR AND SENSORY ASPECTS
Welsch, H., Institute of Aviation Medicine, Germany; Albery, W., Air Force Research Lab., USA; Bles, W., Institute for Human Factors TNO, Netherlands; Human Consequences of Agile Aircraft; May 2001, pp. 49-58; In English; See also 20010056513; Original contains color illustrations; Copyright Waived; Avail: CASI; A02, Hardcopy

Maneuvers which first expose the pilot to less than 1 Gz, followed by an exposure to greater than 1 Gz (Push-Pull) can lead to problems. The aircraft's ability to reach high altitude within a very short time (due to a lift to weight ratio of more than 1) may produce new problems even during normal aircraft operation, e.g., decompression sickness (DCS). The incidence of vestibular problems may be increased by unconventional acceleration exposures. Sensory stimulations may be induced by high acceleration alterations in the roll, pitch, and yaw axes. Simultaneous combinations of aircraft accelerations in the x, y, and z axes can result in longitudinal, lateral, and vertical reaction forces on the pilot. Special restraints may be required for the agile aircraft pilot, especially in the lateral, Gy, direction. The support by an advanced G-protection garment may be needed. For carefree handling, the advanced G-protection device must work without any delay in time even during high acceleration transitions, must include high altitude protection, and must ensure pilot comfort. Furthermore special training devices are required such as the human centrifuge as a dynamic flight simulator (DFS) with a fully gimbaled system, and a spatial (dis)orientation device with an effective motion system. Pilot selection and medical survey with highly sophisticated diagnostic tools will become more and more important. The need of special physical training will be required to enhance the aerobic endurance and the anaerobic power, to train the cardiovascular reflexes, and to increase psychomotoric stability and mental mobility.
Author
Physiological Effects; Physiological Responses; Flight Operations; Human Factors Engineering

20010066259 Ukrainian Armed Forces, Research Inst. of Military Medicine, Irpen, Ukraine
POST-DEPLOYMENT PHASE MEDICAL STATUS MONITORING FUNCTIONS
Varus, Vasiliy, Ukrainian Armed Forces, Ukraine; The Impact of NATO/Multinational Military Missions on Health Care Management; May 2001, pp. 7-1 - 7-3; In English; See also 20010066252; Copyright Waived; Avail: CASI; A01, Hardcopy

History shows that even in peace time, the State sometimes forces military specialists to work under conditions which demand a maximal mobilization of the body functional reserves. Vivid examples are the participation of the Ukraine Armed Forces in the emergency and clean-up operations after the Chernobyl disaster and in the process of dismantling the Ukraine nuclear weapon arsenal, the need to maintain high levels of professional skills and combat strength among military personnel notwithstanding limited materiel supplies and serious financial problems, and the participation of the Ukraine peacekeeping contingent in a multinational military mission. Successful task performance among military personnel is based on their professional capabilities. Taken together, these can be considered as the combat potential that is needed to attain tactical, physical and psychological superiority over adversaries. However, statistics show that a significant part of the specialized troops in the Ukraine Armed Forces, who have high levels of training level and long operational experience, leave the Armed Forces prematurely due to health problems. An analysis of the behavior and the functional status of these individuals has revealed that they have a reduced resistance to the impact of extreme physical and psychosocial

stressors. A study of Ukraine Armed Forces Research Institute of Military Medicine has demonstrated that occupational hazards combined with insufficient physiological, hygienic, and social protection of military personnel should not just be considered as risk factors, but are actually causing damage to the body on cellular, organ, and systemic levels. In view of the need to implement adequate counter measures, a permanent monitoring system has been set up in order to screen the health status of personnel and to evaluate potentially damaging conditions and factors. A military-medical computer database was created by the Military-Medical Service of the Ukraine Armed Forces, as an integral part of a national population health monitoring system. The main task of this hygienic monitoring activity is to provide the military-medical authorities with adequate information.
Derived from text
Health; Medical Services; Human Performance; Monitors

20010066260 Ukrainian Inst. of Public Health, Kiev, Ukraine
THE PROGRAM OF REFORMING THE PUBLIC HEALTH SYSTEM OF UKRAINE AND THE PERSPECTIVES FOR ITS REALIZATION
Moskalenko, V., Ukrainian Inst. of Public Health, Ukraine; Ponomarenko, V., Ukrainian Inst. of Public Health, Ukraine; The Impact of NATO/Multinational Military Missions on Health Care Management; May 2001, pp. 8-1 - 8-3; In English; See also 20010066252; Copyright Waived; Avail: CASI; A01, Hardcopy

An analysis of the public health conditions in Ukraine reveals an unsatisfactory medico-demographic situation which is characterized by a low birth rate, a relatively high mortality rate, a negative population growth, a reduction of the expected human life-span as well as dissemination of a large group of diseases. Obviously, the existing public health system in Ukraine does not meet the requirements of an up-to-date efficient public health system. There have been extensive developments, but experience indicates that there are many economic and organizational problems, as well as strategic flaws in the development of the public health system. I must repeat that the existing system of public health does not meet today's requirements and needs to be improved.
Author
Public Health; Management Systems; Improvement

20010066262 Ministry of Defence, Sixth Central Military Clinical Hospital, Moscow, USSR
THE PROBLEM OF THE PILOT'S PROFESSIONAL HEALTH RESTORATION
Shakula, A., Ministry of Defence, USSR; Pulik, A., Ministry of Defence, USSR; Kuzina, L., Ministry of Defence, USSR; The Impact of NATO/Multinational Military Missions on Health Care Management; May 2001, pp. 10-1 - 10-4; In English; See also 20010066252; Copyright Waived; Avail: CASI; A01, Hardcopy

When analyzing the dynamics of the Russian Airforce air crew's functional condition, working capacity and professional reliability in the process of their flight activity and the results of clinical and physiological examinations, we witness a distinct tendency for deterioration of air crew's level of professional health owing to a complex mixture of psycho-physiological, social, organizational, ecological, and demographic factors. The main tasks when rehabilitating the pilot's functional status in pre-flight or in post-flight situations include: (1) enduring and stable maintenance of operational working capacity; (2) mobilization of psycho-physiological functions to perform the most crucial stages of work; (3) treatment of acute forms of neuro-emotional reactions; (4) treatment of monotony, hypodynamics, and tiredness (exhaustion); (5) rapid restoration of functional status after physical and mental overload; (6) regulating the level of neuropsychic and motivational activity, creating a favorable emotional and sensory background; (7) optimization of adaptive reactions of the organism to shifts in environmental factors and in working conditions; and (8) formation and maintenance of professionally significant aspects of psychosomatic functioning of air crew. Such a variety of tasks necessitates the development and utilization of a wide complex of means and methods for rehabilitating the pilot's functional condition, and these should be able to have an effect on different functional systems of the organism. The specific choice of means and methods depends on the specific nature of the air crew's functional disorder, and the work schedule as well as the personality of each pilot should be taken into consideration. The ultimate aim of the treatment is to maintain proper levels of efficiency by mobilizing the protective and compensatory abilities of the organism. Hence, rehabilitation of the pilot's functional status serves to maintain the pilot's professional health.
Derived from text
Flight Crews; Health; Pilot Performance; Physiology

20010066264 Institute of Aviation Medicine, Germany
BATTLE TRAUMA AND DNBI
Roedig, Erich, Institute of Aviation Medicine, Germany; The Impact of NATO/Multinational Military Missions on Health Care Management; May 2001, pp. 12-1 - 12-4; In English; See also 20010066252; Original contains color illustrations; Copyright Waived; Avail: CASI; A01, Hardcopy

New NATO force structures and strategic concepts emphasise Mobility, Interoperability, Sustainability Jointness, and Multinationality; i.e., deployment of multinational forces to any are for any mission. The very nature of those operations calls for the likelihood of missions in locations far from those of the sending nations, areas that may have challenging factors of geographical conditions, lack of infrastructure, or indigenous populations suffering from hunger, thirst, epidemic and endemic diseases, trauma, or disability. Special environmental and occupational hazards given in the mission areas have to be considered. Therefore appropriate Force health protection is a core competency. It must ensure a full spectrum health services that: (1) emphasise fitness, preparedness, and preventive measures; (2) improve the monitoring and surveillance of forces engaged in military operations; (3) enhance service members and commanders awareness of health threats before they can effect the force; and (4) support the health needs of the military forces and their families across the continuum of medical services.
Author
Health; Medical Services; Protection; Prevention

20010066267 Ukrainian Association of Computer Medicine, Dept. of Clinical Informatics, Kharkiv, Ukraine
PERSPECTIVES OF TELEMEDICINE DEVELOPMENT IN UKRAINE
Mayorov, Oleg Y., Ukrainian Association of Computer Medicine, Ukraine; Ponomarenko, Victor M., Ukrainian Association of Computer Medicine, Ukraine; Kalnish, Valentin V., Ukrainian Association of Computer Medicine, Ukraine; Olenin, Mihael V., Ukrainian Association of Computer Medicine, Ukraine; The Impact of NATO/Multinational Military Missions on Health Care Management; May 2001, pp. 15-1 - 15-5; In English; See also 20010066252; Copyright Waived; Avail: CASI; A01, Hardcopy

The healthcare system in Ukraine has seen the creations of National Medical Networks and Registers (databases). There are two extensively developed medical networks operating within the framework of the computer network of the first generation 'HealthNet'. The most ramified of these two is the National Register of the individuals who are suffering from consequences of the Chernobyl disaster. This Register monitors the health of more than 700,000 persons. A computer network has been created in order to maintain this Register, covering 25 districts and cities under direct central administration - Kiev and Sebastopol. The second most ramified network is the net of the Sanitary and Epidemiological Service fo the Ministry of Health of Ukraine, which is implemented on the computer centers of the district Sanitary and Epidemiological Service, which transmits operative information on the current sanitary, epidemiological, and ecological situation to the Ministry of Health of Ukraine. These nets are integrated in a common net called 'HealthNet'. A third medical network has been created for the monitoring of oncological patients in Ukraine. This network links the regional Oncological Dispensaries with the Institute of Oncology in Keiev, on the basis of which the Oncological Register functions.
Author
Data Bases; Health; Telemedicine; Information Management

20010066269 National Medical Univ., Kiev, Ukraine
IMMUNOGENETIC APPROACH TO PROGNOSIS OF MILITARY SPECIALIST' HEALTH STATUS
Afonina, G., National Medical Univ., Ukraine; Varys, V., National Medical Univ., Ukraine; Yatsenko, V., National Medical Univ., Ukraine; Bely, A., National Medical Univ., Ukraine; Bruzgina, T., National Medical Univ., Ukraine; The Impact of NATO/Multinational Military Missions on Health Care Management; May 2001, pp. 17-1

- 17-4; In English; See also 20010066252; Copyright Waived; Avail: CASI; A01, Hardcopy

In summary, the immuno-genetic approach to the prognosis of changes in the health status of military specialists has enabled us; (1) to develop new methodological and organizational medical principles for the dispensary system and for the rehabilitation of military personnel working under extreme conditions; (2) to set new criteria for a scientific evaluation of working conditions; (3) to unify the medical screening of military personnel which has repeatedly been exposed to adverse and harmful occupational and environmental conditions; and (4) to obtain information on which medical-prophylactic and preventive rehabilitation measures can be based. Derived from text

Monitors; Health; Prognosis

20010076800 Molvaer (Otto I.), Forde, Norway
TECHNICAL EVALUATION REPORT

Molvaer, Otto I., Molvaer (Otto I.), Norway; Operational Medical Issues in Hypo- and Hyperbaric Conditions; June 2001, pp. T-1 - T-8; In English; See also 20010076799; Copyright Waived; Avail: CASI; A02, Hardcopy

Hypo-and hyperbaric exposures are encountered in many routine and special military operations in most of the alliance member countries. Specific operational medical issues affecting air, sea, and land forces have not previously been addressed in a NATO forum. The HFM Panel identified the need to discuss these issues in a wide forum. Symposia are held in conjunction with the bi-annual business meeting of the HFM panel, which is hosted in turn by the alliance nations. On this occasion it was Canada's turn, and since the present issues have been extensively studied in Canadian research establishments, it was natural to choose these topics this time. Man is adapted to tolerate relatively small and slow pressure fluctuations, but can under certain circumstances manage earth-bound, self-propelled travel to any altitude on the planet. Likewise, human physiology functions normally only within narrow boundaries of oxygen partial pressure. Differences in individual tolerance to stress of any kind, including the two mentioned, are great. Accordingly, appropriate selection of personnel for special operations is critical. Also, adequate training and time for adaptation and acclimatization are important. If something goes wrong during operations outside normal environmental conditions, causing disease or injury, effective treatment must be available. In any hypo- or hyperbaric operation, technical solutions are critical. The present symposium addressed all these aspects.

Author

Human Tolerances; Human Performance; Hypobaric Atmospheres; Decompression Sickness; Gas Composition

20010076802 Richland Memorial Hospital, Dept. of Emergency Medicine, Columbia, SC USA
HYPERBARIC OXYGEN: A SCIENTIFIC UPDATE

Bartlett, Robert, Richland Memorial Hospital, USA; Operational Medical Issues in Hypo- and Hyperbaric Conditions; June 2001, pp. KN2-1 - KN2-8; In English; See also 20010076799; Copyright Waived; Avail: CASI; A02, Hardcopy

There are presently 13 indications for hyperbaric oxygen therapy (HBO), which are recognized by the Undersea and Hyperbaric Medical Society and supported by a significant body of scientific evidence. Eleven of these indications are relevant to combat casualty management. From the military perspective, decompression sickness and cerebral gas embolism have received the greatest attention. Recent investigations have established the medical benefits of the remaining nine indications for selected combat injuries. These indications can be broadly grouped into one of three categories: crush injuries and their sequels, shock, and thermal burns.

Author

Embolisms; Casualties; Decompression Sickness; Injuries; Therapy

20010076803 School of Aerospace Medicine, Brooks AFB, TX USA
USAF EXPERIENCE WITH HYPERBARIC THERAPY OF ALTITUDE DECOMPRESSION SICKNESS (1941-1999)

Butler, William P., School of Aerospace Medicine, USA; Wolf, E. George, Jr., School of Aerospace Medicine, USA; Krock, Larry P., School of Aerospace Medicine, USA; Operational Medical Issues in Hypo- and Hyperbaric Conditions; June 2001, pp. 1-1 - 1-9; In English; See also 20010076799; Copyright Waived; Avail: CASI; A02, Hardcopy

Decompression sickness (DCS) is characterized by a plethora of protean symptoms. It can range from mildly annoying to life threatening. Its etiology is tissue and/or vascular bubbles. Indeed, decompression sickness has been a recognized disease since its first report by Triger in 1841. First noted in construction workers laboring in pressurized caissons and later in diving operations, decompression sickness was not even postulated in aviation until 1901 by von Schrotter. Later, Henderson popularized the concept. Over the next forty years some 17,000 cases of altitude DCS were described. At least 743 were considered serious and at least seventeen were fatal. However, altitude decompression sickness was not treated with recompression until Behnke employed it in 1941. Despite his apparent success, supportive care remained the standard. Then, in 1959, under the most extreme of clinical circumstances (DCS shock), Donnell and Norton essentially plucked an aviator from the brink of death with recompression. Thirty-eight hours after entering the chamber the pilot emerged symptom free. This spectacular success launched the research underpinning today's treatment regimen for altitude decompression sickness. Indeed, this paper describes the USAF treatment effort over the last fifty-eight years.

Author

Decompression Sickness; Signs And Symptoms; Therapy; Clinical Medicine

20010076804 School of Aerospace Medicine, Brooks AFB, TX USA
HEADACHE AND DECOMPRESSION SICKNESS: TYPE I OT TYPE II?

Bryce, L. Michelle, School of Aerospace Medicine, USA; Butler, William P., School of Aerospace Medicine, USA; Wolf, E. George, School of Aerospace Medicine, USA; Do, Hollis King, Western Univ. of Health Sciences, USA; Pilmanis, Andrew A., Air Force Research Lab., USA; Krock, Larry, School of Aerospace Medicine, USA; Operational Medical Issues in Hypo- and Hyperbaric Conditions; June 2001, pp. 2-1 - 2-8; In English; See also 20010076799; Original contains color illustrations; Copyright Waived; Avail: CASI; A02, Hardcopy

Decompression Sickness (DCS) results from exposure to reduced environmental pressure. As a result, excess nitrogen evolves from tissues. This gas may then form bubbles that may localize in tissue or vessels. They then create symptoms that range from mild to severe. Commonly, mild symptoms are joint pains and are called Type 1 DCS. Severe symptoms can run a range of neurological manifestations and are called Type 2 DCS. Treatment for Type 1 may only require ground level oxygen, while Type 2 necessitates recompression with 100% oxygen. Headache associated with DCS is not new. Ryles and Pilmanis reported an eleven-year period from the Armstrong Laboratory at Brooks Air Force Base, Texas. Out of 447 subjects, 0.9% reported headache. The German Air Force experience during World War 2 reported a 2.0% incidence rate. Bason searched the US Navy in-flight and altitude chamber experience. His incidence rates were 6.7% and 8.6% respectively. The basis for this paper stems from two cases seen in the Davis Hyperbaric Laboratory and Air Force Research Laboratory at Brooks Air Force Base, Texas. This then prompted a review of headache DCS in the USAF. The traditional view has always been that a headache associated with DCS must be serious, Type 2, or neurologic DCS. Yet in many cases there is no associated neurological symptoms. This begs the question, should headache always be considered Type 2 DCS? This paper will propose an alternative view.

Author

Decompression Sickness; Headache; Signs And Symptoms

20010076805 Canadian Space Agency, Saint Hubert, Quebec Canada
PATENT FORAMEN OVALE AS A RISK FACTOR FOR ALTITUDE DECOMPRESSION ILLNESS

Sullivan, Patrick J., Canadian Space Agency, Canada; Gray, Gary, Defence and Civil Inst. of Environmental Medicine, Canada; Nishi, Ronald Y., Defence and Civil Inst. of Environmental Medicine, Canada; Operational Medical Issues in Hypo- and Hyperbaric Conditions; June 2001, pp. 3-1 - 3-4; In English; See also 20010076799; Copyright Waived; Avail: CASI; A01, Hardcopy

The relation between the presence of a patent foramen ovale (PFO) and the risk of decompression illness (DCI) remains contro-

versial. PFO is a common finding in the general population, with an autopsy prevalence of about 25%. Recent review articles in the diving literature have concluded the presence of a PFO may increase the relative risk for DO but the absolute risk remains low. In space operations, DCI is a significant concern for extravehicular activities (EVA) because of the low suit pressure (the NASA EMU-suit pressure is 4.3 psia, equivalent to about 30,000 feet). The Canadian Space Agency (through contract to DCIEM) is participating in NASA-led Prebreathe Reduction Protocol (PRP) studies to assess the safety and efficacy of reducing EVA oxygen prebreathe time. Reduction in prebreathe time is accomplished by incorporating exercise protocols during a two hour oxygen prebreathe prior to decompression to EVA suit pressure. As for NASA astronauts, DCIEM PRP subjects are screened with a trans-thoracic echocardiogram (TTE). In 48 volunteers at DCIEM screened for the PRP studies with a TTE, 14 (29%) were found to have an echo-probable PFO. In 29 altitude-exposed subjects who had a TTE, there were five echo-probable PFOs. None of these five subjects experienced DCI. Two of these subjects had a high bubble load with grade 4 bubbles on precordial Doppler monitoring. In total there were four cases of Type 1 DO and no Type 2 DCI. None of these subjects had an echo-probable PFO.
Author
Decompression Sickness; Low Pressure; Risk

20010076806 Toronto Univ., Div. of Occupational Medicine, Ontario Canada
THE RELEVANCE OF PATENT FORAMEN OVALE TO TYPE II DCS: AN OVERVIEW OF THE LITERATURE
Saary, Joan, Toronto Univ., Canada; Gray, Gary, Defence and Civil Inst. of Environmental Medicine, Canada; Operational Medical Issues in Hypo- and Hyperbaric Conditions; June 2001, pp. 4-1 - 4-9; In English; See also 20010076799; Copyright Waived; Avail: CASI; A02, Hardcopy

The significance of patent foramen ovale (PFO) in the pathophysiology of Type 2 decompression sickness (DCS) remains controversial. PFOs are common, occurring in approximately one quarter of the normal population, thus making right-to-left shunting of venous gas emboli (VGE) a theoretical concern in both hyper and hypobaric situations. Despite this high prevalence of PFO in the general population, and the relatively common occurrence of venous gas bubbles in diving and altitude exposures, the incidence of Type 2 DCS in diving or with altitude is remarkably low. Although the literature supports a relationship between the presence and size of PFO and cryptogenic stroke, and an increased relative risk of Type 2 DCS with a PFO in divers, the absolute increase in risk accrued is small. Hence, the value of screening is also controversial. This paper presents a brief summary of the literature on PFO's and DCS in altitude and diving, focussing on the latter; as well the analogous literature on cryptogenic stroke; and the results of an examination of the literature on detection of, screening for, and treatment of PFOs. Derived from text
Aeroembolism; Decompression Sickness; Altitude Sickness; Heart Function

20010076807 Air Force Research Lab., Brooks AFB, TX USA
ALTITUDE DCS SUSCEPTIBILITY FACTORS
Webb, James T., Air Force Research Lab., USA; Pilmanis, Andrew A., Air Force Research Lab., USA; Operational Medical Issues in Hypo- and Hyperbaric Conditions; June 2001, pp. 5-1 - 5-4; In English; See also 20010076799; Copyright Waived; Avail: CASI; A01, Hardcopy

Altitude decompression sickness (DCS) susceptibility factors include environmental parameters that influence the incidence and onset of DCS. These parameters include altitude, time at altitude, exercise during exposure, level of denitrogenation (preoxygenation/prebreathe time), ascent rate, and breathing gas composition. The parameters with the most effect on DCS are altitude, time at altitude, exercise during exposure, and level of denitrogenation. These four environmental parameters are determined by mission requirements and can yield 0% to approximately 100% risk of DCS depending on interactions with the other parameters.
Author
Decompression Sickness; Exposure; Altitude Sickness

20010076808 International Univ. of Kyrgyzstan, Bishkek, Kyrgyzstan
PHARMACOLOGICAL CORRECTION OF THE HUMAN FUNCTIONAL STATE IN HIGH ALTITUDE CONDITIONS
Mahnovsky, V. P., International Univ. of Kyrgyzstan, Kyrgyzstan; Operational Medical Issues in Hypo- and Hyperbaric Conditions; June 2001, pp. 6-1 - 6-15; In English; See also 20010076799; Original contains color illustrations; Copyright Waived; Avail: CASI; A03, Hardcopy

The effect of Bemithylum on metabolic changes of glucose, lactate, pyruvate, inorganic phosphate, uric acid, cholesterol, bilirubin, urea, and creatinine in human blood during short-term residences in high mountain regions of Tien Shan and Pamir was investigated. To evaluate effectiveness of bemithylum for correction of metabolism, physical and mental workability of military personnel during short-term residence at 2800m altitude the subjects were tested by 2.5-kilometer marsh with fast temp in mountain canyon as a maximal physical exercise and by psychophysiological test 'The Disarranged Lines', which were carried out before (as control exercise) and after pharmacological procedures. The subjects were separated to two groups: for first one (n = 7) was prescribed to take bemithylum in the dose of 750 mg per day by one or two five-day treatments during initial period of high altitude adaptation, for second one (n = 8) was prescribed to take placebo in the same dose and period of the prescription. All the metabolic indicators mentioned above (excepting lactate and pyruvate) were measured spectrophotometrically in the dried acid extracts of blood samples with standard monotests. It was shown that bemithylum makes essential psychoenergizing and stimulating effects on the processes of concentration and mental workability in conditions of high altitude hypoxia for the sake of direct influence on hemoprotein catabolism, i.e., preventing increase in bilirubin formation to the levels promoting its penetration through blood-brain. Excessive increase of blood cholesterol during physical exercises causes negative influence on human organism and significantly decreases his work-ability at 2800m altitude. Bemithylum prevents significant cholesterol accumulation in blood and simultaneously increases human physical work-capacity in conditions of high altitudes. In persons treated with pharmacological correction with bemithylum, time of making maximal physical exercise decreased more than by twice in comparison with the data received in subjects with placebo-effect. To approve action of bemithylum on increase of human hypoxic resistance and on prompting human adaptation and widening its limits in conditions of high mountain hypoxia was studied character of metabolic adaptation of persons with low hypoxic resistance with treatment of two five-day correction procedures during 30-day residence at 3600 in altitude. The first five-day procedure with bemithylum significantly decreased lactic acid accumulation (for 72.3%) and value of excess lactate (for 76.9%) in blood of subjects (n = 10) in comparison with group of low resistant persons who took placebo (n = 10). Increase of creatinine, cholesterol, uric acid and especially urea was also lowered for 22.5 %, 27.1%, 59.8%, and 122.1% in these persons accordingly. Further after two five-day procedures this actoprotector reduced increase of glucose for 17.6%, lactic acid for 33.8%, uric acid for 19.3%, creatinie for 21.2%, urea for 179.3% and cholesterol for 74.3% in comparison with subjects with placebo-effect. The scheme of one five-day treatment with bemithylum seems to be the most effective both for reducing of terms in achieving urgent adaptation to acute phase of high altitude hypoxia and for transfer of passive form of adaptation into active one. It is necessary to increase treatment with bemithylum to two five-day procedures with obligatory one-day interval between procedures to rise adaptability and resistance of human organism to long-term residence in high altitude conditions.
Author
Cholesterol; High Altitude; Human Tolerances; Hypoxia; Altitude Acclimatization; Physical Exercise

20010076809 National Center of Hygiene, Medical Ecology and Nutrition, Lab. for Physiology, Psychology and Ergonomics, Sofia, Bulgaria
PROGNOZING OF THE RESISTANCE TO HYPOXIA IN MILITARY PILOTS BY CARDIOVASCULAR AND RESPIRATORY PARAMETERS
Nikolova, Rouja, National Center of Hygiene, Medical Ecology and Nutrition, Bulgaria; Slavtcheva, Liliya, Military Medical Academy, Bulgaria; Zlatev, Roumen, Military Medical Academy, Bulgaria;

Vukov, Mirtcho, National Center of Health Informatics, Bulgaria; Operational Medical Issues in Hypo- and Hyperbaric Conditions; June 2001, pp. 7-1 - 7-15; In English; See also 20010076799; Copyright Waived; Avail: CASI; A03, Hardcopy

The effect of hypoxic hypoxia on the autonomic cardiovascular response pattern and the prognosis of resistance to hypoxia were determined after exposure to hypoxic hypoxia in barochamber at simulated altitude 5000 m in 21 military pilots. Cardiovascular: heart rate variability (HRV) measures, heart rate, systolic and diastolic blood pressure, and respiratory parameters: arterial oxygen saturation were examined in pre-hypoxic and post-hypoxic exposure. Although mean values of cardiovascular and respiratory parameters corresponded to referents, hypoxia caused significant effect on HRV measures, diastolic blood pressure, and arterial oxygen saturation. Military pilots were tolerant to hypoxia and did not reveal symptoms of cardiovascular collapse. Hypoxic exposure induced integrated reflex response revealed by significant dependences of the arterial oxygen saturation on spectral power of the R-R intervals in the Respiratory Sinus Arrhythmia band (vagally mediated), and of the diastolic blood pressure on spectral power of the R-R intervals in the Traube - Hering - Mayer band (sympathetically and parasympathetic ally mediated). In post-hypoxic exposure we observed a pattern of increased both sympathetic and parasympathetic activities with prevailing relative dontinance of the vagal cardiac activity over sympathetic one on the control of heart rate variations revealed by significant increase of the mean value of R-R intervals. Prognostic significance for determining of resistance to hypoxia possessed spectral power of the R-R intervals in the temperature band (sympathetically mediated), and the level of physical training assessed by HRV index - PS. Post-hypoxic sympathetic activity evaluated by PT could be predicted by pre-hypoxic level of the percent arterial oxygen saturation and diastolic BP; predictor of the post-hypoxic level of the physical training was pre-hypoxic level Of PT and systolic BP.
Author
Cardiovascular System; Exposure; Hypoxia; Physiological Responses; Human Tolerances

20010076810 Portuguese Air Force Aeromedical Center, ENT Dept., Lisbon, Portugal
ALTERNOBARIC VERTIGO: INCIDENCE IN PORTUGUESE AIR FORCE PILOTS
Subtil, Joao, Portuguese Air Force Aeromedical Center, Portugal; Varandas, Jorge, Portuguese Air Force Aeromedical Center, Portugal; dosSantos, Alves, Portuguese Air Force Aeromedical Center, Portugal; Operational Medical Issues in Hypo- and Hyperbaric Conditions; June 2001, pp. 8-1 - 8-3; In English; See also 20010076799; Copyright Waived; Avail: CASI; A01, Hardcopy

Alternobaric Vertigo is a sudden and transient vertigo caused by asymmetrical changes in middle ear pressure. These changes are directly related to the daily activity of aircraft pilots (and divers). This vertigo strikes often in critical maneuvers (attacks or evasions) causing sudden disorientation. We used an anonymous enquiry, multiple-choice type, preceded by a briefing about alternobaric vertigo. We found 29% of the pilots with one or more episodes of alternobaric vertigo, all being caused directly by rapid ascents and/or brisk Valsalva maneuvers.
Author
Middle Ear Pressure; Vertigo; Valsalva Exercise

20010076812 Spanish Navy Diving Centre, Cartagena, Spain
SPANISH NAVY UP TO DATE DATA IN DCS
Viqueira, Antonio, Spanish Navy Diving Centre, Spain; Rios, Francisco, Spanish Navy Diving Centre, Spain; Pujante, Angel, Spanish Navy Diving Centre, Spain; Gonzalez, Juan deDios, Spanish Navy Diving Centre, Spain; Olea, Agustin, Spanish Navy Diving Centre, Spain; Operational Medical Issues in Hypo- and Hyperbaric Conditions; June 2001, pp. 10-1 - 10-2; In English; See also 20010076799; Copyright Waived; Avail: CASI; A01, Hardcopy

In this paper we present a short update on Spanish Navy decompression sickness (DCS) treated at the Spanish Navy Diving Centre (CBA) located on La Algameca Naval Base (if Cartagena (Southeast, Mediterranean coast) with special emphasis on diagnosis, clinical types, treatment and results, and hyperbaric facilities.
Author
Decompression Sickness; Diagnosis

20010076813 Royal Air Force, Centre of Aviation Medicine, Henlow, UK
HYPOBARIC TRAINING FOR ROYAL AIR FORCE AIRCREW: AN UPDATE
McLoughlin, D. C., Royal Air Force, UK; Operational Medical Issues in Hypo- and Hyperbaric Conditions; June 2001, pp. 12-1 - 12-4; In English; See also 20010076799; Copyright Waived; Avail: CASI; A01, Hardcopy

Until 1998, the Aviation Medicine Training Centre (AMTC) carried out most aviation medicine training for Royal Air Force aircrew at RAF North Luffenham. With the closure of its parent station, AMTC relocated to RAF Henlow in Bedfordshire. At RAF Henlow, it combined with the School of Aviation Medicine from RAF Farnborough, to form the RAF Centre of Aviation Medicine (RAF CAM). The subsequent relocation and refurbishment of the hypobaric chambers, together with the loss of experienced staff, resulted in many challenges for the restoration of hypobaric training at this new unit. This paper states the training requirement, describes the hypobaric chambers, highlights aspects of safety and outlines the hypobaric training profiles and details the results so far.
Author
Pressure Chambers; Aerospace Medicine; Education

20010076814 Royal Air Force, Centre of Aviation Medicine, Henlow, UK
HYPOBARIC TRAINING ISSUES FOR HIGH ALTITUDE AGILE AIRCRAFT
Gradwell, D. P., Royal Air Force, UK; Operational Medical Issues in Hypo- and Hyperbaric Conditions; June 2001, pp. 13-1 - 13-5; In English; See also 20010076799; Copyright Waived; Avail: CASI; A01, Hardcopy

Over the next few years the inventory of many western air forces will change with the introduction into front line service of new high performance aircraft. Such so-called fourth generation combat jets offer enhanced capabilities in terms of speed, agility and altitude, and in particular the potential for these attributes to be combined on a single platform. In Sweden the JAS Grippen has entered service, the development of the F22 Raptor proceeds rapidly in USA and in at least four European countries the introduction of Eurofighter is awaited eagerly. The introduction of these aircraft must be matched by training of the aircrew destined to fly them. Appropriate aeromedical training will, of necessity, be based on the capabilities of the aircraft and thus it will result in a sudden increase in the requirement for more advanced, and more complex hypobaric training.
Author
Education; Flight Crews; Aerospace Medicine

20010076815 Defence and Civil Inst. of Environmental Medicine, Toronto, Ontario Canada
DESIGNING EFFICIENT AND EFFECTIVE, OPERATIONALLY RELEVANT, HIGH ALTITUDE TRAINING PROFILES
Sawatzky, K. David, Defence and Civil Inst. of Environmental Medicine, Canada; Operational Medical Issues in Hypo- and Hyperbaric Conditions; June 2001, pp. 14-1 - 14-8; In English; See also 20010076799; Copyright Waived; Avail: CASI; A02, Hardcopy

Canada experienced a serious case of altitude decompression sickness (DCS) in Jan 1998 and the author was tasked to review the current high altitude training profiles being conducted by the Canadian Forces (CF) to determine their safety, effectiveness, and to recommend any changes that were deemed necessary. This paper is based on that report (dated 07 July 1999) and focuses on the process that was used to answer these questions.
Derived from text
Decompression Sickness; Hypoxia; Evaluation

20010076816 International Univ. of Kyrgyzstan, Bishkek, Kyrgyzstan
MILITARY PERSONNEL SELECTION AND DIAGNOSTIC CONTROL OF HUMAN FUNCTIONAL STATE IN HIGH ALTITUDE CONDITIONS
Mahnovsky, V. P., International Univ. of Kyrgyzstan, Kyrgyzstan; Operational Medical Issues in Hypo- and Hyperbaric Conditions; June 2001, pp. 15-1 - 15-19; In English; See also 20010076799; Copyright Waived; Avail: CASI; A03, Hardcopy

In the paper the initial attempts and modern approach to the evaluation of individual resistance to high altitude hypoxia in the

human organism are reviewed. It is presented a big informative material about using Valsalva maneuver and its modified versions (Burger probe, Flack test, etc.) for a diagnostic estimation of cardiovascular function in the different areas of public medicine and applied human physiology. Specific role is attached use of dosed version of Flack test with 50 sec. duration of strain (DFT) for prognostic evaluation of functional opportunities of the human cardiovascular system, its adaptive potential and regulative functions in high altitude conditions. Clinical observations performed during acute period of adaptation of selected individuals to altitude of 3600 meters demonstrated an 80%-level of verification of the results of this prognosis. Method of military contingent selection and control procedures for healthy service at frontier posts in high mountains of Tien Shan and Pamir are described. It was shown that exemption of people with low resistance to hypoxia (by the results of preliminary selection with the DFT) from military service in mountain regions of Tien-Shan and Pamirs has allowed researches to bring down the morbidity among frontier-guards at high altitude frontier posts by more than 18%; to reduce the number of severe high altitude disadaptations from 70-75 to 35 cases per year; and practically to avoid lethal consequences of severe mountain disease.
Author
Cardiovascular System; Hypoxia; Personnel Selection; Altitude Acclimatization; Human Tolerances

20010076817 Military Aviation Hospital, Kosice, Slovak Republic
SOME PSYCHO-PHYSIOLOGICAL AND COGNITIVE IMPLICATIONS OF HYPOBARIC EXPOSURE DURING SELECTION OF SLOVAK ASTRONAUT CANDIDATES
Dzvonik, Oliver, Military Aviation Hospital, Slovak Republic; Operational Medical Issues in Hypo- and Hyperbaric Conditions; June 2001, pp. 17-1 - 17-5; In English; See also 20010076799; Original contains color illustrations; Copyright Waived; Avail: CASI; A01, Hardcopy

During September and October of 1997, the Military Aviation Hospital in Kosice was entrusted by the Head of the Slovak Air force to select appropriate astronaut candidates for space flight and stay at the Russian Space Station MIR from 26 applicants (experienced elite fighter pilots of the Slovak Air Force) to be placed in a mixed international crew (Slovak, Russian, and French). A resulting seven-day mission of the first Slovak astronaut in February 1999 was successfully completed. Part of the medical-psycho-physiological selection of applicants was exposure to hypobaric chamber conditions. During a 20-minute exposure to 7,600 m (25,000 ft.) of altitude their cognitive capacity was tested (by simplified mathematical tasks) and correlated with other tests of mental capability. The behavioral and mood changes were continuously observed and recorded. Achieved findings were used for the assessment of hypobaric mental work ability of the astronaut candidates. Before and after the hypobaric exposure we took applicants blood samples in order to estimate blood oxygen saturation.
Author
Hypobaric Atmospheres; Mental Performance; Psychophysiology; Hypoxia; Cognition

20010076818 Schiffahrtmedizinisches Inst. der Marine, Kronshagen, Germany
THE ROLE OF PWC IN DECLARING A DIVER FIT
Bettinghausen, Eyke, Schiffahrtmedizinisches Inst. der Marine, Germany; Operational Medical Issues in Hypo- and Hyperbaric Conditions; June 2001, pp. 18-1 - 18-4; In English; See also 20010076799; Copyright Waived; Avail: CASI; A01, Hardcopy

The relative pulse-working-capacity I70, PWC(sub 170rel), is thought to represent the maximum work-load which a person can achieve with constant oxygen-uptake. The general mean of about 3 Watt/kg bodyweight depends on gender and fitness and to a low degree on age. With allowing all kinds of military tasks for women in the German forces it is likely that only women out of the upper regions of the standard deviation of that special group will be chosen for demanding military tasks. Under the condition of steady state the highest work-load with a constant oxygen-uptake is called 'working capacity'. It is accompanied by a heart frequency of 155 to 175 beats per minute and this is called Pulse-Working-Capacity, PWC. If you generally refer to 170 beats per minute then the corresponding work-load is called PWC 170.
Author
Work Capacity; Heart Rate; Physical Fitness; Workloads (Psychophysiology)

20010076819 Institute of Aviation Medicine, Prague, Czechoslovakia
APPLICATION OF HYPO AND HYPERBARIC CHAMBER IN CZECH AIR FORCE
Dosel, Petr, Institute of Aviation Medicine, Czechoslovakia; Sazel, Milos, Institute of Aviation Medicine, Czechoslovakia; Operational Medical Issues in Hypo- and Hyperbaric Conditions; June 2001, pp. 19-1 - 19-5; In English; See also 20010076799; Copyright Waived; Avail: CASI; A01, Hardcopy

This paper provides an overview about using of hypo and hyperbaric chambers at TAM Prague and about hyperbaric oxygen therapy (HBO) indications. Otoscopy and impedance tympanometry are pursued routinely on the instant before all expositions. The pilot's status is monitored by method of pulse oxymetry during all hypoxic tests and demonstrations. The %SpO2 monitoring provides the most valid longitudinal information about clinical status of examined pilots during hypoxia load. The therapy benefit during HBO is evaluated using transcutaneous oxymetry (%PtcO2) in the case of peripheral defects of tissue. It is necessary to achieve %PtcO2 values about 350 - 400 mmHg for successful therapy of tissue defects of the lower extremities. The complex of three hypobaric and one hyperbaric chambers was installed at the Institute of Aviation Medicine in Prague in 1965. All chambers are routinely utilized for medical examinations, training, and other needs of civilian or military pilots and other crew members. All hypo and hyperbaric chambers were rebuilt and redeveloped last year. Modification of our training system to standard STANAG 3114 and increasing of safety of operation were main reasons of that.
Derived from text
Hyperbaric Chambers; Hypobaric Atmospheres; Hypoxia; Aerospace Medicine

20010076820 Hellenic Air Force, Center of Aviation Medicine, Athens, Greece
THE EFFECTS OF NORMOBARIC HYPOXIA IN P(300) PERFORMANCE AND IN THE PERFORMANCE OF WORKING MEMORY TASKS (CPT, N-BACK IN PILOT CADETS WITH NORMAL AND SLOW WAVES SCREENING EEGS
Markou, Ioannis, Hellenic Air Force, Greece; Operational Medical Issues in Hypo- and Hyperbaric Conditions; June 2001, pp. 20-1 - 20-7; In English; See also 20010076799; Copyright Waived; Avail: CASI; A02, Hardcopy

Electroencephalograms (EEGs) are currently used in many countries to screen Air Force pilots candidates. The usefulness of EEG to predict the likelihood of abnormal activity during the training of cadets remains controversial. We investigated whether effects of normobaric hypoxia on P(300)ERP and memory scanning performance are related to the existence of slow waves in the EEG records of cadet pilots. If so, the EEG could serve as a tool for cognitive assessment in candidate pilot screening. Some 30 screening EEG records were re-evaluated for the presence of slow wave activity. Cadets with positive records (N = 15) and a control group (N = 15) performed first, at sea level and then at a normobaric hypoxia: (1) cognitive performance tasks, which were active memory (N-back) and focal attention (CPT); and (2) the auditory 'OddBall' behavioral task for eliciting the P(300) evoked response. The salient finding of this study was that the focal or bilateral brief periods of slow activity in the EEG records of Hellenic air Force cadets combined with conditions of hypoxia did not affect their performance of the memory scanning tasks or their ERPs measured from the auditory OddBall task.
Author
Electroencephalography; Hypoxia; Mental Performance

20010076821 Defence Evaluation Research Agency, Centre for Human Sciences, Gosport, UK
SEVERE DECOMPRESSION ILLNESS FOLLOWING SIMULATED RESCUE FROM A PRESSURISED DISTRESSED SUBMARINE
White, M. G., Defence Evaluation Research Agency, UK; Seddon, F.

M., Defence Evaluation Research Agency, UK; Loveman, G. A. M., Defence Evaluation Research Agency, UK; Jurd, K. M., Defence Evaluation Research Agency, UK; Blogg, S. I., Defence Evaluation Research Agency, UK; Thacker, J. C., Defence Evaluation Research Agency, UK; Operational Medical Issues in Hypo- and Hyperbaric Conditions; June 2001, pp. 21-1 - 21-5; In English; See also 20010076799; Original contains color illustrations; Copyright Waived; Avail: CASI; A01, Hardcopy

If adequate transfer under pressure or recompression assets were not available after rescue from a pressurized Disabled Submarine, the rescuees may suffer from severe or fatal decompression illness (fDCI). Effective methods of reducing the risk of fDCI require characterization. This study uses a large animal model (goat) to estimate the dose (pressure) response (fDCI) relationship. It also addresses the putative intervention measures of breathing oxygen after surfacing or slowing the rate of decompression, as much as the operational cycle time of the rescue vehicle will allow. The efficacy of interventions was determined by exposing a group of twelve animals to the LD(75) pressure. After surfacing at the standard rate, oxygen was delivered by oro-nasal mask for one hour. Alternatively, animals were decompressed through a slow, stepped decompression profile, designed to prevent any microbubble formation on ascent to the surface. Animals were observed for signs of decompression illness (DCI) for up to 10 hours post decompression. They were then humanely killed for necropsy. Animals showing continuously declining vital signs were considered to be dying and were humanely killed. It was shown that respiratory DCI is the most likely cause of death after rapid decompression from deep air saturation. Interventions, such as slowing the rate of decompression, which reduce the bubble load on the lungs on surfacing are likely to be the most effective. Non-recompression therapies, which target improving gas exchange in the lungs, should also improve the outcome.
Author
Decompression Sickness; Rescue Operations; Dosage

20010076822 Naval Medical Research Center, Silver Spring, MD USA
DECOMPRESSION SICKNESS RESEARCH: NEW DIRECTIONS
Kayar, Susan R., Naval Medical Research Center, USA; Dromsky, David M., Naval Medical Research Center, USA; Operational Medical Issues in Hypo- and Hyperbaric Conditions; June 2001, pp. 22-1 - 22-4; In English; See also 20010076799; Original contains color illustrations
Contract(s)/Grant(s): MR04101.00D-1103; M000099.01B-1610;
Copyright Waived; Avail: CASI; A01, Hardcopy

Decompression sickness risk reduction was sought throughout the twentieth century by adjusting dive duration and depth combinations. These adjustments hypothetically minimized inert gas supersaturation in tissues during decompression. The newest efforts in decompression sickness research by scientists at the US Naval Medical Research Center in Silver Spring, Maryland, are focused on fundamentally different approaches. We are seeking means of reducing decompression sickness risk by actively eliminating a critical portion of the body's inert gas load; by increasing the volume of inert gas held in solution by the blood; or by blocking the body's response to intravascular bubbles.
Author
Decompression Sickness; Rare Gases; Human Body

20010076823 Hamilton Research Ltd., Tarrytown, NY USA
USING 'TECHNICAL DIVING' TECHNIQUES FOR SHORT DIVES IN THE 80-100 MSW RANGE
Hamilton, R. W., Hamilton Research Ltd., USA; Silverstein, Joel D., Hamilton Research Ltd., USA; Operational Medical Issues in Hypo- and Hyperbaric Conditions; June 2001, pp. 23-1 - 23-10; In English; See also 20010076799; Copyright Waived; Avail: CASI; A02, Hardcopy

Advanced recreational divers over the last ten years have developed new techniques for open circuit scuba diving in the range to about 100 metres of sea water (msw). These techniques have potential application in military diving. This report describes the new practices, the equipment, procedures, and training required, and some results of several significant operations.
Author
Diving (Underwater); Procedures; Breathing Apparatus

20010076824 Air Force School of Aerospace Medicine, Force Enhancement Hyperbarics, Brooks AFB, TX USA
INTO THE THEATER OF OPERATIONS: HYPERBARIC OXYGEN ON THE MOVE
Krock, Larry P., Air Force School of Aerospace Medicine, USA; Galloway, Thomas R., Air Force School of Aerospace Medicine, USA; Sylvester, James, Air Force School of Aerospace Medicine, USA; Latson, Gary W., Air Force School of Aerospace Medicine, USA; Wolf, E. George, Jr., Air Force School of Aerospace Medicine, USA; Operational Medical Issues in Hypo- and Hyperbaric Conditions; June 2001, pp. 24-1 - 24-7; In English; See also 20010076799; Original contains color illustrations; Copyright Waived; Avail: CASI; A02, Hardcopy

Hyperbaric support for mass casualty injuries resulting from military operations or catastrophic events (i.e., earthquakes, tornadoes, etc.) presently relies upon host country, or at best, local hospital facilities for administration of this therapeutic modality. To get Hyperbaric Medicine (HBO) as close to the point of wounding as tactically possible, thus advancing our wartime readiness mission, and addressing the Joint Health Service Support Plan: Vision 2010, easily transportable HBO systems were sought to support deployed aeromedical evacuation operations from remote theaters of operation. The Emergency Evacuation Hyperbaric Stretcher (EEHS) system provides a ready means of quickly initiating treatment at the incident site and transporting the casualty under pressure to a rear-echelon treatment facility, reducing the risks of permanent injury to warfighters suffering from conditions benefited by treatment with hyperbaric oxygen. Pursuant to that goal of a portable chamber system supporting deployed operations a joint service (USAF/USN) collaborative venture was initiated through the Department of Defense funded Foreign Comparative Testing Program. The Navy conducted a battery of environmental, quality assurance, and operational performance evaluations of the system ultimately leading to the required American Society of Mechanical Engineer (ASME) certification for human occupancy of a pressure vessel. The Air Force component of this initiative performed aeromedical and human factors evaluations of the system leading to aeromedical approval for flight. Exhaustive evaluation of the EEHS demonstrated a robust, yet lightweight and portable chamber system capable of staged-storage, deployability, rapid treatment initiation, and transport of casualties. Current endeavors are developing instructions for deployment and integrating the EEHS into the operational community. Historically, during contingency operations Hyperbaric Medicine relied upon CONUS, or at best host country, hospital facilities for administration of this important treatment modality. This will no longer be the case. Since we will be able to initiate treatment for the combatant in-theater, we will preserve the combatant's optimal mission capability by reducing the magnitude of the injury, and shorten the duration of recovery from battlefield injuries.
Author
Medical Services; Portable Equipment; Hyperbaric Chambers

20010076825 Air Force School of Aerospace Medicine, Davis Hyperbaric Lab., Brooks AFB, TX USA
THE RELEVANCE OF HYPERBARIC OXYGEN TO COMBAT MEDICINE
Wright, James K., Air Force School of Aerospace Medicine, USA; Operational Medical Issues in Hypo- and Hyperbaric Conditions; June 2001, pp. 25-1 - 25-5; In English; See also 20010076799; Copyright Waived; Avail: CASI; A01, Hardcopy

At the Davis Hyperbaric Laboratory, Brooks AFB, TX we have embarked on a series of research protocols designed to determine the efficacy of hyperbaric oxygen treatment (HBO) in combat wounds. Our research has been directed towards finding ways to minimize the extent of combat injury, reduce the consumption of medical resources, speed healing of combat wounds, and improve the result in the healed wound. In this presentation the basic science related to the use of HBO in treating combat wounds will be presented and our current research efforts will be discussed.
Author
Hyperbaric Chambers; Therapy; Wound Healing

20010076826 Air Force School of Aerospace Medicine, Davis Hyperbaric Lab., Brooks AFB, TX USA
3-NITROTYROSINE PREDICTS HEALING IN CHRONIC DIABETIC FOOT WOUNDS TREATED WITH HYPERBARIC OXYGEN

Kalns, John, Air Force School of Aerospace Medicine, USA; Operational Medical Issues in Hypo- and Hyperbaric Conditions; June 2001, pp. 26-1 - 26-6; In English; See also 20010076799; Copyright Waived; Avail: CASI; A02, Hardcopy

The medical art of healing the chronic diabetic foot wound is to a great extent empirical. Current methods rely on visual examination of the wound. For example the appearance of granulation tissue and the formation of new epithelium are often noted as signs of positive treatment effect whereas increasing size of a wound may indicate treatment failure. Since changes in the chronic wound may occur over a period of several weeks, determining the effect of treatment can be problematic, Extensive documentation including photographs can contribute to the objectivity to this process. However extensive documentation adds to the time and cost of treatment and may not be feasible in many health care models. Wound treatment, including amputation, topical growth factors, and HBO are also expensive. Finally, and most importantly, time and effort spent on ineffective treatment is time lost to the patient and perhaps a window of opportunity lost to the physician if the wound progresses and amputation is the only remaining treatment option. When these aspects of wound treatment and evaluation are considered, diagnostic methods that rapidly and objectively determine the effect of wound treatment are of considerable economic and therapeutic importance. Our main hypothesis is that treatments that are effective will increase the production of NO in the chronic non-healing wound. Derived from text

Wound Healing; Therapy; Feet (Anatomy); Nitric Oxide

20010076827 Defence Evaluation Research Agency, Gosport, UK
ROLE OF A CLINICAL HYPERBARIC CHAMBER IN SUPPORT OF RESEARCH AND MILITARY HYPERBARIC OPERATIONS

Florio, John, Defence Evaluation Research Agency, UK; Benton, P., Institute of Naval Medicine, UK; Sawyer, R., Institute of Naval Medicine, UK; Elner, David, Defence Evaluation Research Agency, UK; Operational Medical Issues in Hypo- and Hyperbaric Conditions; June 2001, pp. 28-1 - 28-6; In English; See also 20010076799; Copyright Waived; Avail: CASI; A02, Hardcopy

The DERA Hyperbaric Systems Group is the DERA focus for the research and project support program for diving, escape, and rescue from submarines and for provision of hyperbaric oxygen therapy. The Institute of Naval Medicine is responsible for training military Diving Medical Offices to support MOD Diving operations, submarine escape and rescue operations and Special Forces operations. Jointly they operate the Sir James Watt Hyperbaric Medicine Unit based at the Royal Hospital Haslar. The unit provides clinical treatment, clinical research, equipment evaluation, and training for physicians, and nursing and technical staff.

Author

Clinical Medicine; Hyperbaric Chambers; Therapy; Medical Services

20010076828 Institute of Naval Medicine, Alverstoke, UK
INCIDENCE OF DECOMPRESSION ILLNESS AND OTHER DIVING RELATED MEDICAL PROBLEMS AMONGST ROYAL NAVY DIVERS 1995-1999

Benton, P. J., Institute of Naval Medicine, UK; Operational Medical Issues in Hypo- and Hyperbaric Conditions; June 2001, pp. 29-1 - 29-4; In English; See also 20010076799; Original contains color illustrations; Copyright Waived; Avail: CASI; A01, Hardcopy

The Diving Accident Database held at the Institute of Naval Medicine (INM) contains details of all Royal Navy, and the majority of UK recreational diving accidents, that have occurred since 1990. Details of all Royal Navy dives completed since 1995 are recorded on the Dive Database, also held at WM. The aim of this research was to determine the incidence of decompression illness (DCI), and other diving related medical incidents, amongst Royal Navy divers. The number and type of dives completed by Royal Navy divers (including Ships Divers, Mine Clearance, and Special Forces divers) between 1995 and 1999 was extracted from the Dive Database. Details of all cases of DCI, and other medical incidents, were extracted from the Diving Accident Database. The data was analysed and incident rates calculated for DO and other medical conditions. During the five year period 106,487 dives were completed. Twenty-one cases of DCI occurred (18.8/100,000) and 8 cases of pulmonary barotrauma (7.5/100,000). The incident rate for DO following military air dives was 16/100,000, nitrox dives 19.4/100,000 and heliox dives (1.3 bar constant pO2) 58.4/100,000. The incident rate for DO amongst recreational divers using air was estimated at 7.58/100,000. The incidence of DCI following military air dives is approximately twice that of DCI amongst the recreational diving community, However, there is believed to be significant underreporting of recreational DCI The incidence of DCI following heliox dives is much greater than that associated with air dives. This increased incidence of DCI is probably a factor of depth and increasing decompression stress rather than that of difference in gas mix.

Author

Data Bases; Decompression Sickness; Diving (Underwater); Accidents

20010076829 Defence and Civil Inst. of Environmental Medicine, Toronto, Ontario Canada
EVALUATION OF TREATMENT TABLES FOR SEVERE DECOMPRESSION ACCIDENTS

Khan, Aaron, Defence and Civil Inst. of Environmental Medicine, Canada; Nishi, Ronald, Defence and Civil Inst. of Environmental Medicine, Canada; Flook, Valerie, Unimed Scientific Ltd., UK; Operational Medical Issues in Hypo- and Hyperbaric Conditions; June 2001, pp. 31-1 - 31-3; In English; See also 20010076799; Copyright Waived; Avail: CASI; A01, Hardcopy

This paper describes the requirement for an in-depth analysis of the treatment of a severe decompression accident following a rapid, uncontrolled ascent during deep diving operations using the Canadian Underwater Minecountermeasures Apparatus (CUMA).

Author

Diving (Underwater); Pressure Reduction; Therapy; Decompression Sickness

20010076830 Unimed Scientific Ltd., Aberdeen, UK
MODELLING AND VALIDATION OF TREATMENT TABLES FOR SEVERE DECOMPRESSION ACCIDENTS

Flook, Valerie, Unimed Scientific Ltd., UK; Nishi, Ronald, Defence and Civil Inst. of Environmental Medicine, Canada; Khan, Aaron, Defence and Civil Inst. of Environmental Medicine, Canada; Operational Medical Issues in Hypo- and Hyperbaric Conditions; June 2001, pp. 32-1 - 32-9; In English; See also 20010076799; Copyright Waived; Avail: CASI; A02, Hardcopy

This paper addresses the question of suitable treatment of dysbarism following a severe decompression accident during the use of self-contained breathing apparatus such as the Canadian Underwater Minecountermeasures Apparatus (CUMA) using 1 ata oxygen in helium to a maximum depth of 81 meters. The work involved a dual approach; a theoretical analysis of the problem followed by experimental work designed to follow up specific aspects arising from the theoretical analysis.

Author

Breathing Apparatus; Therapy; Physiological Effects; Bubbles

20010076831 Unimed Scientific Ltd., Aberdeen, UK
RESPIRATORY CHANGES AND CONSEQUENCES FOR TREATMENT OF DECOMPRESSION BUBBLES FOLLOWING SEVERE DECOMPRESSION ACCIDENTS

Flook, Valerie, Unimed Scientific Ltd., UK; Nishi, Ronald, Defence and Civil Inst. of Environmental Medicine, Canada; Khan, Aaron, Defence and Civil Inst. of Environmental Medicine, Canada; Operational Medical Issues in Hypo- and Hyperbaric Conditions; June 2001, pp. 33-1 - 33-7; In English; See also 20010076799; Copyright Waived; Avail: CASI; A02, Hardcopy

Earlier papers describe the theoretical and experimental work carried out to determine the best treatment strategy following severe decompression accidents during use of self-contained breathing apparatus such as the Canadian Underwater Minecountermeasure Apparatus (CUMA). The previous paper has described the extent to which decompression bubbles were formed in anaesthetized animals subjected to controlled primary and treatment hyperbaric procedures; the range of bubble counts was from zero to fatal. Treatment recompression apparently removed the bubbles quickly but in many cases this was not followed by an improvement in the condition of the animal and death occurred during the treatment. The experiments were designed to require minimal surgical intervention prior to the experiments to reduce the possibility that bubble numbers were influenced by surgery and indwelling catheters. There is therefore relatively little information available from which to draw conclusions about the immediate cause of death. Respiratory gases were monitored and a study of the information contained in those

data sheds some light on this and allows a tentative conclusion to be drawn.
Author
Bubbles; Therapy; Decompression Sickness; Experimentation

20010076832 Defence and Civil Inst. of Environmental Medicine, North York, Ontario Canada
EFFECT OF EXERCISE ON BUBBLE ACTIVITY DURING DIVING
Nishi, R. Y., Defence and Civil Inst. of Environmental Medicine, Canada; Jankowski, L. W., Concordia Univ., Canada; Tikuisis, P., Defence and Civil Inst. of Environmental Medicine, Canada; Operational Medical Issues in Hypo- and Hyperbaric Conditions; June 2001, pp. 34-1 - 34-6; In English; See also 20010076799; Original contains color illustrations; Copyright Waived; Avail: CASI; A02, Hardcopy

Exercise is intrinsic to military and commercial diving, and exercise may either increase or decrease the risk of decompression sickness (DCS) after diving. Vann and Thalmann explained the relation between exercise, diving, and the risk of DCS using the parameters of. exercise intensity, exercise duration, and the phase of diving during which exercise is performed. Before diving, intense, vigorous or ballistic exercise which induces muscular soreness may also create microscopic intramuscular gas nuclei which increase the risk of DCS. During diving, the increased metabolic rate of exercise can enhance the rate of inert gas absorption, rapidly causing tissue supersaturation and subsequently increasing the risk of DCS. After diving, vigorous exercise or forceful straining which involve the Valsalva maneuver is associated with cavitation, bubble formation, and the coalescence of micro-bubbles all of which increase the risk of DCS. Thus, although exercise is integral to diving, exercising before, during, and after diving, for several different reasons, may be associated with an increased risk of DCS. Exercising appropriately during decompression, however, may facilitate inert gas elimination and reduce the risk of DCS. While this hypothesis originated with Boycott, Damant and Haldane in 1908, several investigators studying both divers and astronauts have since suggested that exercise may facilitate inert gas elimination and therefore reduce the risk of DCS after diving or during spaceflight. Rather than study DCS symptomatically, bubble activity may be measured directly using Doppler ultrasonic monitoring for venous gas emboli (VGE). The purpose of this investigation was to test the hypothesis that bubble activity can be reduced by performing moderate intermittent exercise during decompression.
Author
Diving (Underwater); Physical Exercise; Pressure Reduction; Risk

20010076833 Aeronautical Medicine Inst., Bucharest, Romania
THERMOGRAPHY: A METHOD FOR THE EVALUATION OF THE RESISTANCE OF MILITARY PILOTS, PARACHUTISTS AND DIVERS AT HYPO AND HYPERBARIC EXPOSURE
Capanu, Ilie, Aeronautical Medicine Inst., Romania; Necula, Eugen, Aeronautical Medicine Inst., Romania; Rodan, Gheorghe, National Inst. for Aerospace Research, Romania; Spataru, Patru, National Inst. for Aerospace Research, Romania; Operational Medical Issues in Hypo- and Hyperbaric Conditions; June 2001, pp. 35-1 - 35-8; In English; See also 20010076799; Original contains color illustrations; Copyright Waived; Avail: CASI; A02, Hardcopy

A mixed team from the AMI and the MAR has developed a long-term activity in the field of the hypo and hyperbaric exposure of aeronautical staff and divers relevant to the topics of the HFM Symposium in the field of 'Selection and Training'. The subject of the work refers to the evaluation of the efficiency of thermography (a non-invasive and not often used investigation method) in the study of the circulatory system answer to the pressure variation during the exposure of the human body to hypo and hyperbaric conditions. Using the thermography, we tried to build-up a monitoring system of the physiological and circulatory system parameters changes at hypo and hyperbaric exposure.
Author
Circulatory System; Human Body; Thermography; Monitors; Hypobaric Atmospheres

20010076834 Air Force Research Lab., Brooks AFB, TX USA
ALTITUDE DECOMPRESSION SICKNESS RISK PREDICTION RESEARCH
Pilmanis, Andrew A., Air Force Research Lab., USA; Petropoulos, Lambros, Air Force Research Lab., USA; Kannan, Nandini, Air Force Research Lab., USA; Webb, James T., Air Force Research Lab., USA; Operational Medical Issues in Hypo- and Hyperbaric Conditions; June 2001, pp. 36-1 - 36-3; In English; See also 20010076799; Copyright Waived; Avail: CASI; A01, Hardcopy

High altitude exposure in aircraft, hypobaric chambers, and with extravehicular activity (EVA) in space results in an inherent risk of altitude decompression sickness (DCS). In the past, general guidelines for safer altitude exposures have been developed through costly, time-consuming studies, each specific to unique scenarios of altitude exposure. Rapidly changing technology in aircraft design and mission requirements demand improved capabilities in predicting DCS risk during mission planning and execution. In 1990, a new bubble growth algorithm and a statistical model based on the existing USAF DCS Database were initiated at Brooks AFB. The first version of this combined model was completed in 1996. A model validation study using human subjects was completed in 1999. An updated version of the model based on the validation results has been produced and the software is being developed.
Author
Algorithms; Decompression Sickness; Exposure; Hypobaric Atmospheres; Risk

20010076835 Defence Evaluation Research Agency, Centre for Human Sciences, Farnborough, UK
ALTITUDE DECOMPRESSION ILLNESS: THE OPERATIONAL RISK AT SUSTAINED ALTITUDES UP TO 35,000 FT
Lee, V. M., Defence Evaluation Research Agency, UK; Hay, A. E., Defence Evaluation Research Agency, UK; Operational Medical Issues in Hypo- and Hyperbaric Conditions; June 2001, pp. 37-1 - 37-13; In English; See also 20010076799; Original contains color illustrations; Copyright Waived; Avail: CASI; A03, Hardcopy

Altitude decompression illness (DCI) is generally considered to be a risk at altitudes in excess of 18,000 ft. UK military aircrew are therefore not routinely exposed to altitudes in excess of this, however, there are circumstances such as loss of cabin pressure, parachute operations, and high cabin altitudes in future aircraft, when exposure to altitudes in excess of 18,000 ft may be necessary. A series of experiments were carried out at the DERA Centre for Human Sciences to investigate the risk of venous gas emboli (VGE) and DO symptoms at altitudes up to 35,000 ft. Subjects were exposed, for a maximum of four hours, to: (1) simulated altitudes between 20,500 ft and 25,000 ft breathing an oxygen/nitrogen gas mixture; (2) 25,000 ft breathing 100% oxygen with and without one hour of prior denitrogenation; and (3) simulated altitudes up to 35,000 ft with one hour prior denitrogenation. It was concluded that VGE formation will occur at cabin altitudes that will be encountered by aircrew of future agile aircraft although only 7% of subjects developed symptoms. Exposure to 25,000 ft breathing an oxygen/nitrogen gas mixture resulted in VGE and symptoms significantly earlier than during exposures to 20,500 ft and 22,500 ft. Furthermore, exposure to 25,000 ft for four hours breathing either gas mix or 100% oxygen, without prior denitrogenation, incurred a substantial risk of developing symptoms of DCI. Denitrogenation, however, for one hour prior to decompression provided effective protection against development of symptoms of DCI at 25,000 ft for subjects at rest. Finally, subjects exposed to 35,000 ft developed VGE and symptoms of DCI significantly earlier than subjects exposed to 25,000 ft.
Author
Aeroembolism; Decompression Sickness; Exposure; High Altitude; Risk

20010076836 Consejo Superior de Investigaciones Cientificas, Dept. of Neuroanatomy and Cellular Biology, Madrid, Spain
EXPRESSION OF NEURONAL AND INDUCIBLE NITRIC OXIDE SYNTHASE ISOFORMS AND GENERATION OF PROTEIN NITROTYROSINE IN RAT BRAIN FOLLOWING HYPOBARIC HYPOXIA
Rodrigo, J., Consejo Superior de Investigaciones Cientificas, Spain; Castro-Blanco, S., Consejo Superior de Investigaciones Cientificas, Spain; Fernandez, A. P., Consejo Superior de Investigaciones Cientificas, Spain; Alonso, D., Consejo Superior de Investigaciones Cientificas, Spain; Serrano, J., Consejo Superior de Investigaciones Cientificas, Spain; Fernandez-Vizarra, P., Consejo Superior de Investigaciones Cientificas, Spain; Encinas, J. M., Consejo Superior

de Investigaciones Cientificas, Spain; Lopez, J. C., Consejo Superior de Investigaciones Cientificas, Spain; GomezdeTerreros, F. J., Hospital del Aire, Spain; Operational Medical Issues in Hypo- and Hyperbaric Conditions; June 2001, pp. 38-1 - 38-13; In English; See also 20010076799; Sponsored in part by Ministerio de Educacion y Cultura
Contract(s)/Grant(s): 0.8/0052.1/1996; PM98/0126/C02/01; Copyright Waived; Avail: CASI; A03, Hardcopy

The expression of neuronal and inducible nitric oxide synthase (nNOS and NOS) and nitrotyrosine immunoreactivities in the cerebral cortex, caudate putamen, islands of Calleja, hippocampus, superior colliculus and cerebellum of rats submitted to hypobaric hypoxia equivalent to an altitude of 30,000 feet (9144 m, barometric pressure 230.4 Torr) were analyzed and semiquantitatively assessed by means of light microscopic immunocytochemistry and Western blotting using specific polyclonal antibodies. Changes in the expression of these components were directly related to the reduction of barometric pressure, time of exposure to hypobaric hypoxia and the post-hypoxic recovery period. After exposure to hypobaric hypoxia for 8 hours and a recovery period of 24 hours, an intense vasodilatation was also demonstrated in blood vessels throughout the brain and especially in blood vessels of the hypothalamic magnocellular accessory group. Animals treated with N(omega)-nitro-L-arginine methyl ester (L-NAME) did not show changes in nNOS and iNOS expression but displayed decreased nitrotyrosine immunoreactivity. The anatomical and biochemical modifications following four or eight hours of hypobaric hypoxia demonstrated by this study may be related to some of the psychological changes described after human exposure to high altitude.
Author
Hypoxia; Neurophysiology; Nitric Oxide; Proteins

20010076837 Centre d'Expertise du Personnel Navigant, Bordeaux Armees, France
BENEFITS OF HIGH-ALTITUDE CAISSON FOR EVALUATION OF INDIRECT MANIFESTATION OF TUBAL DYSPERMEABILITY *[INTERET DU CAISSON D'ALTITUDE POUR L'EVALUATION DE MANIFESTATIONS INDIRECTES DE DYSPERMEABILITE TUBAIRE]*
Matthias, Alain, Centre d'Expertise du Personnel Navigant, France; Maugey, Bernard, Laboratoire de Medecine Aerospatiale, France; Clere, Jean Michel, Laboratoire de Medecine Aerospatiale, France; Operational Medical Issues in Hypo- and Hyperbaric Conditions; June 2001, pp. 39-1 - 39-5; In French; See also 20010076799; Translated into English by SCITRAN, Inc.; Copyright Waived; Avail: CASI; A01, Hardcopy

In order to ensure that their mission is conducted in complete safety, airline crews are regularly subjected to a medical examination whose aim it is to be certain of the integrity of their major functions. The examination of the ears is centered on the functions of hearing, balance, and tubal permeability. At the time of the entrance medical examination, the tubal permeability is quantified by tympanogram study. An anomaly of the middle ear study results in a declaration of inaptitude. That is why the candidate who has an abnormal tympanogram is put in an actual situation of pressure in a high-altitude caisson or tank to make certain that an erroneous decision of inaptitude will not be made. Of 19 candidates tested only two exhibited disturbances, one showed a pain that required halting of the altitude descent, the other presented barotraumas without any manifestation of pain. The 17 other persons had a tubal permeability such that the test was carried out under good conditions. Their medical aptitude was therefore declared. This paper discusses conditions under which this test was carried out and the methodological precautions taken to ensure safety.
Author
Middle Ear; Physical Examinations; Flight Crews

20010076839 Center for Pulmonary Rehabilitation, Hilversum, Netherlands
MODELING APPROACH FOR OXYGEN EXCHANGE IN THE HUMAN LUNG UNDER HYPOBARIC CONDITIONS
Lindhout, J. P. F., Center for Pulmonary Rehabilitation, Netherlands; vandeGraaff, M., Center for Pulmonary Rehabilitation, Netherlands; vandeGraaff, R. C., Center for Pulmonary Rehabilitation, Netherlands; Westermann, C. J. J., Saint Antonius Hospital, Netherlands; Bogaard, J. M., University Hospital, Netherlands; Operational Medical Issues in Hypo- and Hyperbaric Conditions; June 2001, pp. 41-1 - 41-11; In English; See also 20010076799; Original contains color illustrations; Copyright Waived; Avail: CASI; A03, Hardcopy

Physical effort at high altitude can result in serious complications in the human respiratory system even for healthy and well-trained persons. For people with a pulmonary disorder, already a stay at moderate altitude, or transportation by air (e.g., in case of medical evacuation) can lead to significant problems caused by hypoxemia. In both circumstances the oxygen tension of the inspired air (PI, O2) and therefore of the arterial blood (Pa, O2) drops substantially. For healthy people - if at rest - this causes no considerable problems because their arterial oxygen saturation at such altitudes still will be at the horizontal part of the oxyhaemoglobin dissociation curve.
Author
Blood; Gas Exchange; Hypobaric Atmospheres; Lungs

20010076841 Defence Evaluation Research Agency, Centre for Human Sciences, Farnborough, UK
THE EFFECT OF INCREASED FULL COVERAGE ANTI-G TROUSER INFLATION PRESSURE ON THE CARDIOVASCULAR RESPONSES TO POSITIVE PRESSURE BREATHING
Byrne, J. A., Defence Evaluation Research Agency, UK; Lewis, R. C., Defence Evaluation Research Agency, UK; Brown, T. L., Defence Evaluation Research Agency, UK; Operational Medical Issues in Hypo- and Hyperbaric Conditions; June 2001, pp. 44-1 - 44-20; In English; See also 20010076799; Copyright Waived; Avail: CASI; A03, Hardcopy

Positive pressure breathing (PPB) provides short term emergency protection against hypoxia in the event of cabin depressurization in military aircraft operating at altitudes exceeding 40,000 feet. PPB, however, causes significant disturbance to the normal function of the respiratory and circulatory systems, thus limiting the level and duration of pressure breathing that can be tolerated. The adverse effects of PPB can be lessened by the use of counter-pressure garments, which apply an external pressure to the surfaces of the trunk and the lower limbs. We investigated the potential benefits of increased lower limb counter-pressure as a measure to optimize cardiovascular function during PPB. We conclude that cardiovascular function is impaired during PPB whilst wearing FCAGTs inflated to a pressure equal to PPB pressure. In addition, our results demonstrate that near normal cardiovascular function can be maintained during PPB if FCAGTs are inflated to 1.5 x PPB pressure, 2 x PPB pressure, or 2.5 x PPB pressure.
Author
Cardiovascular System; Heart Function; Physiological Responses; Pressure Breathing

20010076842 Wolf (E. George, Jr.), San Antonio, TX USA
DECOMPRESSION SICKNESS, EXTRAVEHICULAR ACTIVITIES, AND NITROGEN INDUCED OSMOSIS: BRIAN HILLS REVISITED
Wolf, E. George, Jr., Wolf (E. George, Jr.), USA; Krock, Larry, Air Force School of Aerospace Medicine, USA; Operational Medical Issues in Hypo- and Hyperbaric Conditions; June 2001, pp. 45-1 - 45-3; In English; See also 20010076799; Copyright Waived; Avail: CASI; A01, Hardcopy

Decompression sickness has been recognized as an environmental and occupational illness for over 100 years, yet we still today are trying to find ways to minimize its effects or prevent the illness altogether. As the International Space Station is being built over the coming years, new challenges arise in attempting to manage the demands of physical labor in space without producing decompression sickness. The etiology of decompression sickness has evolved over the past century from Boyle and Bert to Haldane to many of those reading this article. Oftentimes, it is interesting to return to earlier work and research and see how it may apply to today's problems. The purpose of this paper is to take a historical perspective on one researcher of yesteryear, Dr. Brian Hills. It is not to advocate any changes in decompression sickness preventive measures.
Derived from text
Decompression Sickness; Etiology

20010076843 Air Force Research Lab., Brooks AFB, TX USA
OPTIMIZING DENITROGENATION FOR DCS PROTECTION
Webb, James T., Air Force Research Lab., USA; Pilmanis, Andrew A., Air Force Research Lab., USA; Operational Medical Issues in Hypo- and Hyperbaric Conditions; June 2001, pp. 46-1 - 46-3; In English; See also 20010076799; Copyright Waived; Avail: CASI; A01, Hardcopy

Altitude decompression sickness (DCS) is caused by gas bubble formation resulting from tissue nitrogen supersaturation during decompression. Altitude DCS symptoms range from joint pain to neurological disfunction and respiratory distress. An important DCS countermeasure, other than adequate cabin pressurization, is prebreathing (preoxygenation), i.e., breathing 100% oxygen before decompression to denitrogenate body fluids and tissues. The inspiration of 100% oxygen excludes nitrogen and sets up a gradient in the tissues to allow tissue nitrogen to diffuse into the capillaries and be transported to the lungs for expiration. The longer this process is continued, the more effective the denitrogenation and the lower the incidence of DCS symptoms. The need for improvements in denitrogenation is driven by modifications in aircraft missions involving reduction or elimination of cabin pressurization, and development of new aircraft designed with pressurization systems that are inadequate to prevent DCS during some mission scenarios which the aircraft are capable of performing.
Author
Decompression Sickness; Denitrogenation; Oxygen Breathing

20010076844 Army Research Inst. of Environmental Medicine, Thermal and Mountain Medicine Div., Natick, MA USA
BENEFIT OF ACCLIMATIZATION TO MODERATE ALTITUDE ON ARTERIAL OXYGEN SATURATION FOLLOWING RAPID ASCENT TO 4300 M
Muza, Stephen R., Army Research Inst. of Environmental Medicine, USA; Rock, Paul B., Army Research Inst. of Environmental Medicine, USA; Zupan, Michael, Air Force Academy, USA; Miller, James, Air Force Academy, USA; Operational Medical Issues in Hypo- and Hyperbaric Conditions; June 2001, pp. 47-1 - 47-7; In English; See also 20010076799; Copyright Waived; Avail: CASI; A02, Hardcopy

During long-term exposures (days-to-weeks) to high altitudes, humans compensate for the decreased inspired oxygen partial pressure (PIO2) by progressively increasing ventilation. For example, following rapid ascent to 4,300 m elevation, ventilation increases during the first six to eight days. The rise in ventilation produces a decrease in arterial carbon dioxide partial pressure (PaCO2) and a concomitant increase in PaO2. The time course and magnitude for acquiring altitude acclimatization has been well described for unacclimatized lowlanders rapidly ascending to high altitudes. However, the magnitude of altitude acclimatization developed in lowlanders residing at moderate elevations (1,000 - 2,000 m) has not been well documented. Moreover, there is no comprehensive database that describes the degree to which acclimatization to moderate altitudes improves arterial oxygenation upon rapid ascent to higher altitudes. We propose that lowlanders acclimatized to moderate altitudes will maintain a higher level of arterial oxygenation when rapidly ascending to higher altitudes compared to lowlanders residing a low altitudes. Numerous military installations housing large numbers of military personnel are located at moderate altitudes. Development of a database that describes the distribution of arterial oxygen saturation in lowlanders acclimatized to a range of moderate altitudes would provide commanders with ascent timetables to higher elevations that take full advantage of the personnel's acclimatization status. Furthermore, current limits on the time that aircrews of unpressurized aircraft may fly above 3,048 m without supplemental oxygen are based on studies of unacclimatized lowlanders. Altitude-acclimatized aircrews may be able to safely operate beyond these limits, thus enhancing operational capability. The purpose of this study was to determine the distribution of arterial oxygen saturation following rapid ascent to high altitude (4,300 m) in military personnel residing at moderate (approximately 2,000 m) altitude. These data were compared to similar measurements previously collected on men and women residing near sea level.
Author
Altitude Acclimatization; Arteries; Exposure; Oxygen; Ventilation

20010076845 Institute of Aviation Medicine, Aviation Physiology Div., Koenigsbrueck, Germany
PHYSIOLOGICAL AND CLINICAL FINDINGS DURING LATENT HYPOXIA IN THE HYPOBARIC CHAMBER
Welsch, Heiko, Institute of Aviation Medicine, Germany; Operational Medical Issues in Hypo- and Hyperbaric Conditions; June 2001, pp. 48-1 - 48-4; In English; See also 20010076799; Original contains color illustrations; Copyright Waived; Avail: CASI; A01, Hardcopy

Since 1995 the hypobaric training of aircrew, in accordance with STANAG 3114, is performed in the highly sophisticated air conditioned hypobaric chamber of the German Air Force Institute of Aviation Medicine, Division II at Koenigsbrueck, Germany. It is a main part of overall 150 Physiological Training Courses per year.
Author
Hypobaric Atmospheres; Hypoxia; Physiology

20010083585 Research and Technology Organization, Human Factors and Medicine Panel, Neuilly-sur-Seine, France
MEDICATION FOR MILITARY AIRCREW: CURRENT USE, ISSUES, AND STRATEGIES FOR EXPANDED OPTIONS *[LES MEDICAMENTS POUR LES EQUIPAGES MILITAIRES: CONSOMMATION ACTUELLE, QUESTIONS ET STRATEGIES POUR DES OPTIONS ELARGIES]*
Medication for Military Aircrew: Current Use, Issues, and Strategies for Expanded Options; June 2001; 166p; In English; See also 20010083586 through 20010083603; CS-ROM contains full text document in PDF format
Report No.(s): RTO-TR-014; AC/323(HFM-014)TP/14; ISBN 92-837-1063-0; Copyright Waived; Avail: CASI; C01, CD-ROM; A08, Hardcopy; A02, Microfiche

Working Group 26 evaluated issues pertaining to expanding the range of medications available for use in military aircrew. Working Group 26 completed its work under the auspices of the Human Factors and Medicine Panel of the NATO Research and Technology Agency. The group conducted a survey of medication use policies among NATO air forces and presents the data. The group also reviewed the current state of aeromedical issues for treatment of certain commonly encountered conditions in military aircrew. The working group also presents discussions of the general approaches to determining the suitability of medication for use in military aircrew for therapeutic indications and for operational indications. The ethics of such decisions in military aerospace medicine are also discussed. The best means for evaluating specific areas of aeromedical concern when studying medication are presented. Medications identified as candidates for immediate study for the benefit of military aircrew and their air forces are used for hypertension, lipid disorders, depression, anxiety disorders, malaria prevention, promotion of performance during prolonged sleepless periods, and promotion of sleep for short periods of time to support sustained operations. The working group provides recommendations to enhance knowledge between nations about aeromedical research on medications effects and aeromedical experience with medication. The group proposes use of cooperative research between nations to accelerate the process of answering questions about aeromedically significant side effects and expand the range of medications available for use in military aircrew.
Author
Aerospace Medicine; Flight Crews; Drugs; Pharmacology; Human Factors Engineering

20010083586 Air Force Special Operations Command, 16th Medical Group, Hurlburt Field, FL USA
MEDICATION FOR MILITARY AIRCREW: CURRENT USE, AND STRATEGIES FOR EXPANDED OPTIONS - INTRODUCTION
Ediger, Mark, Air Force Special Operations Command, USA; Medication for Military Aircrew: Current Use, Issues, and Strategies for Expanded Options; June 2001, pp. 1-4; In English; See also 20010083585; Copyright Waived; Avail: CASI; A01, Hardcopy

Working Group 26 was originally chartered by the AGARD Aerospace Medicine Panel to study issues relating to use of medications in military aircrew. The group began its work in April, 1997 and was charged to continue its work by the newly created NATO Research and Technology Organization in 1998 following the dissolution of AGARD. Working Group 26 has completed its work under the auspices of the Human Factors and Medicine Panel.
Author
Aerospace Medicine; Flight Crews; Human Factors Engineering; Drugs

20010083587 Air Force School of Aerospace Medicine, Brooks AFB, TX USA
ANTIHYPERTENSIVE DRUGS IN AIRCREW
Pickard, Jeb S., Air Force School of Aerospace Medicine, USA; Medication for Military Aircrew: Current Use, Issues, and Strategies for Expanded Options; June 2001, pp. 5-14; In English; See also 20010083585; Copyright Waived; Avail: CASI; A02, Hardcopy

Chronic diseases are relatively rare in the military aviator population, but essential hypertension is a distinct exception. Estimates of prevalence vary considerably, in part due to the typical liability of early hypertension in the young to middle-aged, predominantly Caucasian population characteristic of NATO air forces. Suffice it to say that, for most services, antihypertensive drugs represent some of the most common, if not the commonest, waivers for chronic medication use in aviation personnel.
Author
Antihypertensive Agents; Hypertension; Drugs; Aircraft Pilots

20010083588 Defence and Civil Inst. of Environmental Medicine, Toronto, Ontario Canada
PHARMACOLOGIC AGENTS FOR THE MANAGEMENT OF ASTHMA IN AIRCREW
Gray, G. W., Defence and Civil Inst. of Environmental Medicine, Canada; Medication for Military Aircrew: Current Use, Issues, and Strategies for Expanded Options; June 2001, pp. 21-26; In English; See also 20010083585; Copyright Waived; Avail: CASI; A02, Hardcopy

Asthma is an inflammatory condition of the airways, producing variable bronchoconstriction. First line therapy is directed at controlling the inflammatory process with agents such as inhaled steroids, nedocromil, and the newer leukotriene inhibitor drugs. In severe cases, systemic steroids or other immunosuppressive therapies may be required for suppression of inflammation. Other agents provide symptomatic relief of bronchospasm. Short-acting beta-agonists are the mainstay for providing relief of acute episodes. Anticholinergic inhaled agents have a minor role in acute episodes. Long-acting beta-agonists are used to smoothe long-term symptom control and help reduce the frequency of acute episodes when combined with inhaled steroids. Theophylline has bronchodilator properties and may have antiinflammatory properties, but has a narrow therapeutic window. Other newer agents are currently being developed, including anti-immunoglobulin E, antitryptase and anti-CD4 agents. These newer agents may expand the options for control of asthma over the next decade. The prevalence of asthma has been increasing in recent years, and occurs not uncommonly in an aviator population. Evaluation of aircrew requires a comprehensive respiratory assessment, including a detailed history of symptoms, triggering factors, and past treatment requirements, and a pulmonary function assessment with evaluation of bronchial reactivity. The challenge for the flight surgeon is to define as clearly as possible the severity of the disease, and to control the condition with agents acceptable for continuing aircrew duties. Good control of the inflammatory process with inhaled steroids alone, while minimizing or eliminating the need for bronchodilators, may allow continuing available for the control of asthma from an aeromedical perspective. Reference (17) is a website providing excellent background information for both patients and physicians on asthma. Reference (10) provides a more comprehensive overview of the assessment and treatment of asthma in aircrew. In fast-jet aircrew, any degree of asthma is generally unacceptable because varying degrees of small-airway dysfunction may predispose to airway collapse with +Gz, thus contributing to both acceleration atelectasis and aggravation of the ventilation/perfusion mismatch induced by G. In non fast-jet aircrew, stability of bronchial reactivity and full control of asthmatic symptoms with acceptable medications is the prime objective. Aircrew whose airway reactivity is normalized and well-controlled on acceptable medications may be considered for continuing duties.
Author
Respiratory Physiology; Asthma; Flight Crews; Drugs; Pharmacology

20010083589 National Defence Headquarters, Ottawa, Ontario Canada
H1-ANTIHISTAMINES AND AIRCREW
Davidson, Ronald A., National Defence Headquarters, Canada; Nicholson, Anthony N., Defence Evaluation Research Agency, UK; Stone, Barbara M., Defence Evaluation Research Agency, UK; Pickard, Jeb S., Air Force School of Aerospace Medicine, USA; Medication for Military Aircrew: Current Use, Issues, and Strategies for Expanded Options; June 2001, pp. 27-30; In English; See also 20010083585; Copyright Waived; Avail: CASI; A01, Hardcopy

For many years it was accepted that antihistamines were among the safest medications in the world, and this reputation was enhanced by the development of the so-called second generation compounds, which were largely free of adverse effects on vigilance and performance. It was against this background that there was wide agreement that they could be used safely by aircrew. However, cardiotoxicity has now become an issue with these antihistamines, and the confidence which was once placed in their use for aircrew requires re-examination. With certain antihistamines, plasma concentrations of the parent compound, caused by overdosage, inhibition of metabolism, or hepatic insufficiency, may lead to prolongation of the QT(sub c) interval, and thus to ventricular dysrhythmias similar to those seen with quinidine. Such dysrhythmias are likely due to blockade of the rapidly activating component (I(sub Kr)) of the delayed rectifier potassium channel, since inhibition of this channel is common to virtually all drugs that prolong the QT interval.2 There is no evidence of any correlation between I(sub Kr) inhibition and antihistamine potency or H1 receptor blockade.
Derived from text
Antihistaminics; Drugs; Flight Crews; Aerospace Medicine

20010083590 Italian Air Force, Inst. for Aeromedical Evaluation, Rome, Italy
ENDOCRINE DRUGS IN AIRCREW
Danese, Daniele, Italian Air Force, Italy; Medication for Military Aircrew: Current Use, Issues, and Strategies for Expanded Options; June 2001, pp. 31-42; In English; See also 20010083585; Copyright Waived; Avail: CASI; A03, Hardcopy

Hormones are molecules that are synthesized and secreted by groups of cells clustered in specific tissues, usually known as glands, and are released into the blood, exerting biochemical effects on target cells at a distance from their site of origin. Hormones are chemical messengers, endogenous compounds that are involved in both intracellular and extracellular communication. The site of action is determined by the presence of specific hormone receptors on or in target cells. Hormones have diverse molecular structures, as summarized in Table 1. Historical interest in hormonal effects is ancient;1,3 the physiological and morphological effects of accidental or intentional castration of man or domestic animals were known to be correlated with the loss of testes. Later, transplanted testes were demonstrated to prevent development of capon characteristics in the castrated rooster, and later still it was shown that testicular extracts, and finally testosterone itself, corrected the deficit. Similar discoveries were made concerning the ovary, the adrenal, and the thyroid, through the classic experiments of surgical extirpation and replacement. In the beginning, hormonal therapy was developed by using natural substances extracted from animal or human organs, but now these have been almost entirely supplanted by synthetic hormones. Worldwide prevalence of endocrine disorders varies significantly. Certain endocrine conditions are among the most prevalent diseases in general medicine, particularly diabetes mellitus, obesity, and thyroid disorders. In clinical endocrinology practice, the most common endocrine diseases are diabetes mellitus, thyrotoxicosis, hypothyroidism, nodular goiter, diseases of the pituitary gland and diseases of the adrenal gland. This monograph will focus mainly on three hormonal therapeutic agents: adrenal hormones, insulin, and thyroid hormones. Hypothalmic and pituitary hormones will not be considered, since they are used primarily in diagnostic procedures, and only very rarely for medical treatment.
Derived from text
Endocrine Systems; Endocrine Glands; Hormones; Flight Crews; Drugs

20010083591 Italian Air Force, Inst. for Aeromedical Evaluation, Rome, Italy
GASTROINTESTINAL DRUGS IN AIRCREW
Danese, Daniele, Italian Air Force, Italy; Medication for Military Aircrew: Current Use, Issues, and Strategies for Expanded Options; June 2001, pp. 43-46; In English; See also 20010083585; Copyright Waived; Avail: CASI; A01, Hardcopy

Gastrointestinal diseases (GID) are common disorders in the general population. More than 50% of patients presenting with GID complaints are in the decades of life typical of military personnel, and

GID represent some of the commonest reasons for medication waivers in military aircrew. The clinical course of most gastrointestinal disorders tends to be chronic, with unpredictable remissions and relapses, and a propensity for complications which may be acutely disabling or may chronically worsen the individual's general health. The development of GID by aviation personnel often leads to variable degrees of limitation in their flying duties, largely depending on the natural history of the disorder. The most common GID of aeromedical interest are: gastroesophageal reflux; peptic ulcer, both gastric and duodenal; chronic inflammatory disease of the bowel, predominantly regional enteritis and ulcerative colitis; and irritable bowel. Pharmacologic agents to treat GID include many of the most commonly used drugs in medicine, including antacids, histamine H2-receptor blocking agents, anticholinergics, proton pump inhibitors, antimotility agents, and antibacterials.
Derived from text
Gastrointestinal System; Flight Crews; Drugs; Aerospace Medicine

20010083592 Service de Medecine Aeronautique, Centre Prinicipal d'Expertise Medicale du Personnel Mavigant, Clamart, France
MALARIA CHEMOPROPHYLAXIS IN MILITARY AIRCREW
Paris, Jean-Francois, Service de Medecine Aeronautique, France; Gourbat, Jean Pierre, Service de Medecine Aeronautique, France; Doireau, Phillipe, Service de Medecine Aeronautique, France; Medication for Military Aircrew: Current Use, Issues, and Strategies for Expanded Options; June 2001, pp. 47-56; In English; See also 20010083585; Copyright Waived; Avail: CASI; A02, Hardcopy

Malaria prophylaxis of aircrew is one of the more frequent problems with which a flight surgeon has to cope. This article examines the aeromedical aspects of the topic by reviewing the indications and side effects of the available chemoprophylactic drugs. A potential for neurosensory side effects constitutes the most frequent reason to reject the use of a particular drug. Knowledge about malaria prophylaxis is in a constant state of change; thus, recommendations are liable to become rapidly outmoded. Whatever the chosen drug, chemoprophylaxis should always be integrated into a global management strategy which includes antivector measures on an individual and collective scale.
Author
Aerospace Medicine; Flight Crews; Parasitic Diseases; Prophylaxis

20010083593 Defence Evaluation Research Agency, Centre for Human Sciences, Farnborough, UK
DRUGS AND AIR OPERATIONS
Nicholson, Anthony N., Defence Evaluation Research Agency, UK; Stone, Barbara M., Defence Evaluation Research Agency, UK; Turner, Claire, Defence Evaluation Research Agency, UK; Medication for Military Aircrew: Current Use, Issues, and Strategies for Expanded Options; June 2001, pp. 57-66; In English; See also 20010083585; Copyright Waived; Avail: CASI; A02, Hardcopy

There can be little doubt that the performance of air personnel may deteriorate during intensive and sustained operations, and much thought has been given to the use of hypnotics to preserve sleep, and stimulants to enhance vigilance. The effect of these two possibilities may be complementary. Stimulants may be particularly useful for critical periods of work likely to involve impaired performance when used against a background of hypnotics to ensure adequate sleep in limited rest periods. However, the use of hypnotics and stimulants demands the most careful evaluation of each individual drug, and of their interactions. In the case of hypnotics the overriding consideration, assuming efficacy, is duration of action which is dependent on the dose and the pharmacokinetic profile. Determination of the minimal dose is essential. Information on the pharmacokinetic profile is useful, though it is not possible to predict duration of action from such data with any certainty. It is often implied that the elimination half-life determines the duration of action, but duration of action also depends on rate of absorption and distribution, and so all three phases of the pharmacokinetic profile, as well as the minimum effective concentration for a particular effect, are involved. It is essential to carry out experimental studies to determine the minimum dose to produce sleep during a limited period of rest, and to ensure that impairment of performance does not extend into the work period.
Derived from text
Flight Crews; Pharmacology; Amphetamines; Central Nervous System Stimulants

20010083594 Service de Medecine Aeronautique, Clamart, France
MELATONIN AND AIRCREW: IS AN OPERATIONAL USE RECOMMENDED?
Doireau, Phillipe, Service de Medecine Aeronautique, France; Paris, Jean-Francois, Service de Medecine Aeronautique, France; Gourbat, Jean Pierre, Service de Medecine Aeronautique, France; Medication for Military Aircrew: Current Use, Issues, and Strategies for Expanded Options; June 2001, pp. 67-72; In English; See also 20010083585; Copyright Waived; Avail: CASI; A02, Hardcopy

The time difference-related desynchronization syndrome commonly called 'jet lag' raises many issues in terms of performance and flight safety during rapid military deployments. Of several physical and pharmacological solutions recently proposed, the use of melatonin is generally considered to be a promising coping strategy. In this literature review, the authors have highlighted practical unsolved considerations in the use of melatonin. A conservative attitude, especially about its use in aircrew, currently remains necessary because of the lack of scientific certainties.
Author
Flight Crews; Hormones; Pharmacology; Jet Lag; Desynchronization (Biology)

20010083595 Royal Air Force Inst. of Aviation Medicine, Farnborough, UK
MEDICATION FOR MOTION SICKNESS
Benson, Alan, Royal Air Force Inst. of Aviation Medicine, UK; Medication for Military Aircrew: Current Use, Issues, and Strategies for Expanded Options; June 2001, pp. 73-88; In English; See also 20010083585; Copyright Waived; Avail: CASI; A01, Hardcopy

Over the years many medicinal remedies have been proposed for the prevention of motion sickness. The number of drugs that has been tested is large, but relatively few are effective, and none can completely prevent the development of signs and symptoms in everyone in all provocative motion environments. When the motion is relatively mild and only 10% of the unmedicated population suffer from sickness, then use of a drug such as hyoscine (scopolamine) can increase protection so that all but 2% of the population remain symptom-free. But when the motion is of such severity and duration that 50% are sick when no drug is given, a large dose of hyoscine (1.0mg) still leaves 8% of the population unprotected. In life-rafts, sickness rates approaching 100% have been reported, so it is not surprising that a significant proportion of the occupants will still suffer from sea sickness even when the dose of drug given is sufficient to cause side-effects. None of the drugs of proven efficacy in the prophylaxis of motion sickness is entirely specific and all have side-effects. Both the anti-histaminics (such as promethazine, dimenhydrinate or cinnarizine) and the anti-cholinergic, hyoscine, are also central depressants and can cause impairment of performance. Hyoscine, at all therapeutic doses, has been shown to cause a performance decrement on tasks requiring continuous attention and memory storage for new information, but only at doses greater than 0.8mg does it interfere with performance of a pursuit tracking task. Promethazine 25mg and cinnarizine at doses greater than 30 mg have also been shown to impair psychomotor performance. Other side effects of hyoscine, notably blurred vision, sedation, dizziness and dry mouth, may also contribute to performance decrement.
Derived from text
Drugs; Motion Sickness; Physiological Effects; Pharmacology

20010083596 Royal Netherlands Air Force, Health Care Services, The Hague, Netherlands
MEDICATION DATABASE
Lam, Berry, Royal Netherlands Air Force, Netherlands; Medication for Military Aircrew: Current Use, Issues, and Strategies for Expanded Options; June 2001, pp. 89-108; In English; See also 20010083585; Copyright Waived; Avail: CASI; A03, Hardcopy

In April 1997, Working Group 26 undertook to facilitate international collaboration in determining the suitability of medications for use by military aviators. The group is focusing on two areas: 1) current knowledge and experience in use of medications by military aviators, and 2) means of international collaboration on the study of new medications for use by military aviators. To simplify the task, while still including the vast majority of drugs used in aviators, the group discussion decided to focus on eight disease categories: Hypertension, Malaria Prophylaxis, Asthma, Allergic Rhinitis, Allergic Dermatitis, Other Manifestations of Allergy, Hyperlipidaemia and Disorders of the Digestive System. Furthermore it was decided to

see which drugs for operational use were thought to be important.
Derived from text
Data Bases; Aerospace Medicine; Drugs

20010083597 Air Force Special Operations Command, 16th Medical Group, Hurlburt Field, FL USA
ETHICAL CONSIDERATIONS IN USE OF MEDICATIONS BY MILITARY AIRCREW
Ediger, Mark, Air Force Special Operations Command, USA; Medication for Military Aircrew: Current Use, Issues, and Strategies for Expanded Options; June 2001, pp. 109-112; In English; See also 20010083585; Copyright Waived; Avail: CASI; A01, Hardcopy

Those who make decisions employ a moral component in the process of rationalizing a chosen course of action - ethics. Military flight surgeons often find themselves making decisions involving competing interests, those of the military service whose mission they support (and by whom the flight surgeon is generally employed), and the best interests of the individual military aviator with whom exists a physician-patient relationship. In this respect, military flight surgeons and occupational medicine physicians share a common challenge. However, when the employer is a military service and the employee/patient is a military aviator, the ethical issues for the physician take on added dimensions beyond those typically encountered in the practice of occupational medicine.
Author
Aircraft Pilots; Ethics; Flight Surgeons; Drugs

20010083598 Air Force School of Aerospace Medicine, FECI, Brooks AFB, TX USA
APPROACH TO AEROMEDICAL DRUG EVALUATIONS
Pickard, Jeb S., Air Force School of Aerospace Medicine, USA; Medication for Military Aircrew: Current Use, Issues, and Strategies for Expanded Options; June 2001, pp. 113-116; In English; See also 20010083585; Copyright Waived; Avail: CASI; A01, Hardcopy

Therapeutic drugs acceptable for military aviation are those agents which, without significantly affecting occupational proficiency and safety, may be administered to aviators to alleviate disease which is not itself disqualifying for aviation, or which may allow return to flying status as a result of therapy. This is in contrast to operational medications, pharmacologic agents administered to healthy members to enhance force effectiveness in areas as diverse as vigilance, performance enhancement, Circadian adaptation, and prophylaxis. As a rule, while operational medications may be an issue in any military member, therapeutic agents are of particular concern only in aviation or other high-performance, high-risk occupations, where subtle alterations in psychologic or physiologic performance might have profound effects on performance or safety. For other military members, the standard assessment of clinical efficacy and tolerability which occurs prior to the marketing of a therapeutic agent is usually sufficient for treatment decisions. In the case of operational medications, subtle drug-induced alterations in the aviator are certainly of interest as well, but the relative lack of clinical experience and medical literature means that, as a rule, even the most basic questions of efficacy and safety need to be answered first.
Author
Aerospace Medicine; Aircraft Pilots; Drugs; Pharmacology

20010083599 Service de Medecine Aeronautique, Clamart, France
GOLD STANDARD TESTS
Doireau, Philippe, Service de Medecine Aeronautique, France; Pickard, Jeb S., Air Force School of Aerospace Medicine, USA; Lam, Barry, Royal Netherlands Air Force, Netherlands; Gray, Gary W., Defence and Civil Inst. of Environmental Medicine, Canada; Eliopoulos, Themis, Greece; Roedig, Erich, Germany; Medication for Military Aircrew: Current Use, Issues, and Strategies for Expanded Options; June 2001, pp. 117-138; In English; See also 20010083585; Copyright Waived; Avail: CASI; A03, Hardcopy

While drug toxicity which targets internal, especially excretory, organs is aggressively evaluated in laboratory and clinical trials prior to marketing, adverse effects on systems of interest to aviation, e.g., the special senses, are only rarely evaluated. It is the intent of this guideline to recommend tests which have been successfully employed in earlier research to detect medication effects. Where that proved impossible, tests were chosen that were known to be sensitive in detecting abnormalities typically caused by medications (e.g., contrast sensitivity function for visual abnormalities). Also, tests with a history of use in clinical medicine were preferred, since they were more likely to be available, well validated, and familiar to potential investigators, although for some areas such as cognitive testing this was impractical. Since baseline testing should be readily available when investigating drug effects, tests with a higher degree of sensitivity and reproducibility were preferred to those with greater specificity. Note that some tests have been discussed, not necessarily to be recommended. Also, even for those tests that are recommended, we do not mean to imply that all tests be done on all drugs; the testing regimen should be tailored to potential areas of concern. The following sections are arranged by physiologic category, consisting of cognitive functions, special senses, critical organs, and physiologic responses to environmental demands such as acceleration.
Author
Physiological Responses; Drugs; Clinical Medicine; Physiological Tests; Aerospace Medicine

20010083600 Air Force School of Aerospace Medicine, FECI, Brooks AFB, TX USA
LOSARTAN POTASSIUM: A REVIEW OF ITS SUITABILITY FOR USE IN MILITARY AIRCREW
Pickard, Jeb S., Air Force School of Aerospace Medicine, USA; Medication for Military Aircrew: Current Use, Issues, and Strategies for Expanded Options; June 2001, pp. 139-144; In English; See also 20010083585; Copyright Waived; Avail: CASI; A02, Hardcopy

The renin-angiotensin system (RAS) plays a central role in the control of blood pressure, and in particular it is felt to play a crucial role in neurogenic hypertension. The RAS appears to act through two mechanisms, affecting the acute control of blood pressure through the pressor action of angiotensin II, and the long-term regulation of cardiovascular remodeling through the growth factor properties of angiotensin II.
Derived from text
Flight Crews; Vasoconstrictor Drugs; Aerospace Medicine; Hypertension

20010083601 Air Force School of Aerospace Medicine, FECI, Brooks AFB, TX USA
LOSARTAN POTASSIUM: EVALUATING THE TREATED AVIATOR FOR MEDICAL WAIVER
Pickard, Jeb S., Air Force School of Aerospace Medicine, USA; Medication for Military Aircrew: Current Use, Issues, and Strategies for Expanded Options; June 2001, pp. 145-146; In English; See also 20010083585; Copyright Waived; Avail: CASI; A01, Hardcopy

A review of the literature concerning losartan has shown it to be a potential candidate for use in aircrew. Based on clinical studies and postmarketing surveillance, no side effects have been uncovered that would preclude aviator use a priori. However, a number of questions remain to be addressed before deciding whether losartan is suitable for use in military aviation. For example, data is either lacking or scant concerning cognitive, vestibular, and acceleration effects, to name a few.
Derived from text
Aircraft Pilots; Aerospace Medicine; Vasoconstrictor Drugs; Pharmacology

20010083602 Air Force Special Operations Command, 16th Medical Group, Hurlburt Field, FL USA
CURRENT USE OF MEDICATIONS IN NATO MILITARY AIRCREW
Ediger, Mark, Air Force Special Operations Command, USA; Medication for Military Aircrew: Current Use, Issues, and Strategies for Expanded Options; June 2001, pp. 147-152; In English; See also 20010083585; Copyright Waived; Avail: CASI; A02, Hardcopy

The collection of data from NATO nations regarding use of medications for aircrew contains some interesting information and is a tool of great potential utility to NATO flight surgeons. In our survey of therapeutic medications use, we concentrated on medications used for long-term or sustained therapy for medical conditions. We did not survey nations on short-term therapeutic agents such as antibiotics. As we stated in the introduction, there is a growing requirement to expand the range of medications available for use in aircrew. Allow me to repeat the list of factors driving these requirements: 1) Rapid expansion of the number of new drugs available for clinical indications, offering enhanced disease management; 2)

Diminished funding for research making it difficult for any single nation to completely evaluate aeromedical issues for one or more drugs; 3) Sustained round-the-clock operations and rapid deployment across multiple time zones; 4) Increased emphasis on mitigating the risk of chronic disease development through early intervention and improved disease management to reduce risk of disease complications; 5) Focus on population-based medicine leading to the understanding that consistently sound disease management, often involving newer pharmacologic agents, will maintain higher qualification rates in the aviation force; 6) Emphasis on force protection and emerging infectious disease threats increases demand for effective pharmacologic prophylaxis; and 7) Absence of information on aeromedically significant.
Derived from text
Aerospace Medicine; Drugs; Flight Crews; North Atlantic Treaty Organization (NATO); Pharmacology

20010083603 Institut de Medicine Aerospatiale Armee, Dept. of Physiology, Bretigny sur Orge, France
MODAFINIL: A MOLECULE OF MILITARY INTEREST
Pierard, C., Institut de Medicine Aerospatiale Armee, France; Lallement, G., CRSSA, France; Peres, M., Institut de Medicine Aerospatiale Armee, France; Lagarde, D., Institut de Medicine Aerospatiale Armee, France; Medication for Military Aircrew: Current Use, Issues, and Strategies for Expanded Options; June 2001, pp. 77-88; In English; See also 20010083585; Copyright Waived; Avail: CASI; A03, Hardcopy

Modafinil (Modiodal(R)) is a synthetic molecule prescribed for the treatment of narcolepsy and idiopathic hypersomnia. It could be used by armed forces for sustained or continuous operations. The wakening effect is potent: modafinil allows healthy volunteers to stay awake and efficient for more than 60 hours, without side-effects. The mechanism of action of modafinil is complex, involving the adrenergic system (central 1-postsynaptic receptors), associated with serotoninergic, GABAergic and probably dopaminergic systems. Moreover, the implication of excitatory amino acids was demonstrated. The anterior hypothalamic nucleus could be the main and specific target for modafinil. It could induce wakefulness by different mechanisms, as compared with other classical vigilance enhancing drugs such as amphetamines. A neuroprotective effect against neurotoxic organophosphate agents was recently discovered.
Author
Drugs; Pharmacology; Hypersomnia; Narcolepsy; Military Operations; Wakefulness

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BEHAVIORAL SCIENCES

19990068483 Royal Air Force, Aviation Medicine Training Centre, Henlow, UK
NIGHT VISION TRAINING OF ROYAL AIR FORCE AIRCREW
Hansford, N. G., Royal Air Force, UK; Aeromedical Aspects of Aircrew Training; June 1999, pp. 3-1 - 3-2; In English; See also 19990068480; Copyright Waived; Avail: CASI; A01, Hardcopy; A01, Microfiche

This paper offers a summary of the Night Operations Familiarization Course which is currently employed at the Royal Air Force (RAF) Aviation Medicine Training Centre. A brief history of the development of the course is followed by a summary of both the academic and practical aspects of the current syllabus. The paper ends with a look towards future developments in Electro-Optic Training within the RAF.
Author
Aerospace Medicine; Night Vision; Training Analysis; Education; Flight Crews; Personnel Development

19990068484 Headquarters Army Aviation, Middle Wallop, UK
AVIATION MEDICINE AND PHYSIOLOGY TRAINING IN THE BRITISH ARMY
Braithwaite, M. G., Headquarters Army Aviation, UK; Aeromedical Aspects of Aircrew Training; June 1999, pp. 4-1 - 4-5; In English; See also 19990068480; Copyright Waived; Avail: CASI; A01, Hardcopy; A01, Microfiche

The mission of Army Aviation Medicine is to enhance the effectiveness of Army Aviation by promoting health and minimizing the deleterious physical, psychological and pathological factors associated with flight. This is delivered by providing integrated operational aeromedical guidance, education, research, and analysis to optimize the fighting power of the force and enhance flight safety. The aeromedical training to aircrew is clearly a most important function. An outline of the Aviation medicine and Physiology training given to British Army helicopter pilots is presented. Training for other aircrew is described in brief at the end of the paper.
Derived from text
Aerospace Medicine; Education; Training Analysis; Flight Crews; Pilot Training; Armed Forces (Foreign); United Kingdom

19990068485 Portuguese Air Force Aeromedical Center, Lisbon, Portugal
PORTUGUESE PHYSIOLOGICAL TRAINING PROGRAM
Ribeiro, Nuno, Portuguese Air Force Aeromedical Center, Portugal; Rocha, Carlos, Portuguese Air Force Aeromedical Center, Portugal; Aeromedical Aspects of Aircrew Training; June 1999, pp. 5-1 - 5-5; In English; See also 19990068480; Copyright Waived; Avail: CASI; A01, Hardcopy; A01, Microfiche

Aviation physiology training for Portuguese Air Force aircrew is carried out at the Physiological Training Unit (PTU) of the Aeromedical Center (AMC) since 1984 located at Lumiar Base in Lisbon. For a better understanding of AMC integration we present the POAF organization with reference to the personnel branch and AMC structure.
Derived from text
Aerospace Medicine; Education; Training Analysis; Personnel Development; Flight Crews; Portugal; Armed Forces (Foreign)

19990068486 Royal Danish Air Force, Medical Squadron 590, Vaerloese AFB, Denmark
ROYAL DANISH AIR FORCE AVIATION PHYSIOLOGICAL TRAINING PROGRAM
Oldenburg, Julia N. S., Royal Danish Air Force, Denmark; Nielson, Jan Nybo, Royal Danish Air Force, Denmark; Aeromedical Aspects of Aircrew Training; June 1999, pp. 9-1 - 9-6; In English; See also 19990068480; Copyright Waived; Avail: CASI; A02, Hardcopy; A01, Microfiche

This paper opens with a brief history of aviation physiological training in the Royal Danish Air Force (RDAF). The details of courses currently run by Medical Squadron 590 are included together with information about the content of each course. In addition, the paper includes specific details of the practical demonstrations provided to enhance learning and expand on the concepts taught during the theoretical portion of the course. The practical demonstrations included in all training courses are the unaided night vision and spatial disorientation demonstrations. An additional practical demonstration in the hypobaric chamber is included during courses for fighter (F-16), transport (C-130, G-III, Challenger, and NATO AWACS), helicopter (Westland Lynx), and high altitude parachutist (HAP) aircrew.
Author
Aerospace Medicine; Education; Training Analysis; Flight Crews; Armed Forces (Foreign); Denmark

19990068487 Institute of Aviation Medicine, Prague, Czechoslovakia
AVIATION PHYSIOLOGY TRAINING PROGRAMME OF CZECH AIR FORCE
Dosel, Petr, Institute of Aviation Medicine, Czechoslovakia; Aeromedical Aspects of Aircrew Training; June 1999, pp. 10- 1 - 10-3; In English; See also 19990068480; Copyright Waived; Avail: CASI; A01, Hardcopy; A01, Microfiche

The lecture provides the basic information about aviation physiology training of the Czech Army. It takes notice of the circumstances of that system's development. The paper emphasized that aviation physiology training system is approaching STANAG 3114 and presented the necessary changes for the future.
Author
Aerospace Medicine; Education; Training Analysis; Flight Crews; Pilot Training

19990068488 Canadian Forces Air Command, School of Aeromedical Training, Winnipeg, Manitoba Canada
CANADIAN FORCES AEROMEDICAL TRAINING PROGRAMME
Glass, K. C., Canadian Forces Air Command, Canada; Aeromedical Aspects of Aircrew Training; June 1999, pp. 11-1 - 11-6; In English; See also 19990068480; Copyright Waived; Avail: CASI; A02, Hardcopy; A01, Microfiche

The Canadian Armed Forces has a long history of providing Aeromedical Training to its Flight Personnel. There have been as many as ten Physiology Training sites operating, including one in Lahr, Germany. The Canadian Forces School of Aeromedical Training offers Aeromedical Training, Aircrew Survival Training, Basic Night Vision Device Training and provides Hyperbaric Chamber Treatments for military personnel and emergency civilian cases.
Derived from text
Aerospace Medicine; Armed Forces; Canada; Education; Training Analysis; Flight Crews

19990068489 Institute of Aviation Medicine, Aerospace Physiology, Koenigsbrueck, Germany
AEROSPACE PHYSIOLOGY TRAINING FOR GERMAN FEDERAL ARMED FORCES
Valentiner, A., Institute of Aviation Medicine, Germany; Aeromedical Aspects of Aircrew Training; June 1999, pp. 12-1 - 12-8; In English; See also 19990068480; Copyright Waived; Avail: CASI; A02, Hardcopy; A01, Microfiche

This paper provides minutes and some of the slides of the briefing presented at the HFM Workshop in San Diego, Ca., USA, from 14-16 Oct. 1998. The paper introduces our current practice of 'Aeromedical Training of Flight Personnel' in regard to STANAG 3114.
Derived from text
Aerospace Medicine; Education; Training Analysis; Personnel Development; Pilots (Personnel); Flight Crews; Armed Forces; Germany

19990068490 Hellenic Air Force General Hospital, Hellenic Center of Aviation Medicine, Athens, Greece
AIRCREW AEROMEDICAL TRAINING HELLENIC AIR FORCE PROGRAM
Paxinos, Odysseas, Hellenic Air Force General Hospital, Greece; Aeromedical Aspects of Aircrew Training; June 1999, pp. 14-1 - 14-2; In English; See also 19990068480; Copyright Waived; Avail: CASI; A01, Hardcopy; A01, Microfiche

Aviation physiology training and medical certification for both military and civil aircrews is carried out in Greece in the Center of Aviation Medicine (KAI). Military aircrew training is carried out with reference to STANAG 3114 and includes altitude chamber flights and spatial disorientation trainer rides. Centrifuge training for fighter pilots is provided under contract abroad. Refresher lecture courses are provided annually and practical training every 3 years. The Center is currently being upgraded to meet future needs.
Author
Aerospace Medicine; Education; Flight Crews; Greece; Armed Forces (Foreign)

19990068491 Royal Air Force, Center of Aviation Medicine, Henlow, UK
ROYAL AIR FORCE HIGH ALTITUDE PHYSIOLOGICAL TRAINING
Gradwell, D. P., Royal Air Force, UK; Aeromedical Aspects of Aircrew Training; June 1999, pp. 15-1 - 15-4; In English; See also 19990068480; Copyright Waived; Avail: CASI; A01, Hardcopy; A01, Microfiche

The Royal Air Force continues to operate aircraft at altitudes in excess of 50,000 feet. To provide short-term protection against hypoxia in the event of loss of cabin pressure the aircrew are trained in the technique of positive pressure breathing and the use of counter-pressure garments at altitude. Although the life support systems of many military fast jet aircraft provide pressure breathing it is commonly limited to a pressure of 30 mmHg above ambient. The use of breathing pressures higher than 30 mmHg requires the use of counter-pressure assemblies to reduce the adverse physiological side effects of pressure breathing. The aim of the high altitude aviation medicine training is to familiarize the aircrew with the personal equipment they must wear, the operation of the aircraft's oxygen systems in the event of a decompression at high altitude, to become competent in the performance of the correct pressure breathing technique and finally to undergoing a rapid decompression from 25,000 ft to 56,000 ft in three seconds in a hypobaric chamber.
Derived from text
Aerospace Medicine; Education; Flight Crews; Pilot Training; High Altitude; Hypobaric Atmospheres; High Altitude Breathing; High Altitude Pressure; Pressure Breathing; Emergency Breathing Techniques

19990068492 Aeromedical Inst., Soesterberg, Netherlands
AVIATION PHYSIOLOGY AND MEDICINE TRAINING IN THE ROYAL NETHERLANDS AIR FORCE AND AEROMEDICAL INSTITUTE
Los, M. J. B., Aeromedical Inst., Netherlands; Aeromedical Aspects of Aircrew Training; June 1999, pp. 16-1 - 16-5; In English; See also 19990068480; Copyright Waived; Avail: CASI; A01, Hardcopy; A01, Microfiche

Nearly all aviation physiology and aviation medicine training, from here on referred to as 'aeromedical training' is performed at the Aeromedical Institute. In this civilian non-governmental institute both RNLAF and civilian personnel are involved in aeromedical (and psychological) training, selection, examinations and research for military and civilian aircrew from many countries. The training section within the Aeromedical Institute currently consists of four RNLAF Aviation Physiologists and a RNLAF Flight Surgeon. Besides training they are also involved in aircrew equipment, especially oxygen systems and anti-G protection. They also participate in aeromedical evaluations and research generally when the human centrifuge and the hypobaric chambers are involved. The latest asset of the training section is a six axis FSDD which stands for Flight Simulated Disorientation Demonstrator.
Derived from text
Aerospace Medicine; Education; Flight Crews; Armed Forces (Foreign); Netherlands

19990068493 Headquarters Army Aviation, Middle Wallop, UK
IN-FLIGHT DEMONSTRATION OF SPATIAL DISORIENTATION IN THE BRITISH ARMY
Braithwaite, M. G., Headquarters Army Aviation, UK; Aeromedical Aspects of Aircrew Training; June 1999, pp. 17-1 - 17-9; In English; See also 19990068480; Copyright Waived; Avail: CASI; A02, Hardcopy; A01, Microfiche

Following didactic instruction, most aircrew are able to experience some of the disorientating illusions and limitations of the orientational senses in a variety of ground-based devices. In order to reinforce instruction in spatial disorientation (SD) within environment in which they operate, British Army Air Corps helicopter pilots also receive an airborne demonstration of the limitations of their orientation senses. Since 1982, a specific SD sortie has been programmed towards the end of the basic rotary-wing phase of flight training approximately 6 weeks after the aeromedical training module, and before students commence rotary-wing instrument flight training. Refresher sorties are flown every 4 years. The conduct of the SD sortie is described in detail. Analysis of helicopter accidents demonstrates that this training is operationally effective by contributing towards the reduction of SD-related mishaps. It is cost-effective and the addition of this type of in-flight demonstration to the aeromedical training syllabus is regarded as being of great value to British Army helicopter aircrew. Similar instruction could be readily adopted by other services.
Author
Aerospace Medicine; Aircraft Pilots; Flight Crews; Flight Training; Education; Pilot Training; Armed Forces (Foreign); United Kingdom

19990068495 Bureau of Medicine and Surgery (Navy), Washington, DC USA
USA NAVY (USN) AVIATION SURVIVAL TRAINING PROGRAM
Matthews, Robert A., Bureau of Medicine and Surgery (Navy), USA; Aeromedical Aspects of Aircrew Training; June 1999, pp. 6-1 - 6-3; In English; See also 19990068480; Copyright Waived; Avail: CASI; A01, Hardcopy; A01, Microfiche

This paper describes the current USN aeromedical training program. Training requirements, training locations and training methodologies are listed. Details of curriculums, including topics, hours and training devices utilized are presented. Hypobaric chamber

profiles for altitude simulations are also described.
Author
Aerospace Medicine; Education; Training Devices; Training Analysis; Personnel Development; United States; Navy

19990068496 Air Force Medical Operations Agency, Bolling AFB, Washington, DC USA
USA AIR FORCE (USAF) AEROSPACE PHYSIOLOGY PROGRAM
Sventek, Jeffrey C., Air Force Medical Operations Agency, Bolling AFB, USA; Aeromedical Aspects of Aircrew Training; June 1999, pp. 13-1 - 13-7; In English; See also 19990068480; Copyright Waived; Avail: CASI; A02, Hardcopy; A01, Microfiche

This paper describes the recent changes made to the USAF Aerospace Physiology training programs as presented during the October 14-16, 1998 Human Factors & Medicine Panel Workshop on Aeromedical Aspects of Aircrew Training. The USAF Aerospace Physiology training programs have changed in an effort to reduce risk and to make the training more operationally relevant for the students.
Author
Aerospace Medicine; Education; Flight Crews; Pilot Training; Armed Forces (United States)

20000011736 Headquarters Army Aviation, Middle Wallop, UK
CONTROLLING THE HAZARD OF SPATIAL DISORIENTATION IN ROTARY-WING OPERATIONS BY ENHANCED TRAINING
Braithwaite, M. G., Headquarters Army Aviation, UK; Current Aeromedical Issues in Rotary Wing Operations; August 1999, pp. 1-1 - 1-6; In English; See also 20000011735; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

Spatial Disorientation (SD) remains an important source of attrition in military flying. Several recent symposia and technical meetings have recommended various initiatives to control this hazard such as education training research and technological improvements. This paper gives details of the various training initiatives that have been established through the Technical Working Group (TWO) of the Triservice Aeromedical Research Panel. and the international forum of Working Pam: 61 of the Air Standardization Coordinating Committee (ASCC). Nations and individual services were asked to contribute to a panel to consider how the hazard of SD could best be controlled by means of training enhancements. All aspects of existing and potential training were reviewed: classroom instruction ground based demonstrations and training in both dedicated SD demonstrators and flight simulators. in flight demonstration and training, SD training for special forms of flight; and training the SD trainers. It was clear from this review that many improvements were required, and that most could readily be adopted. It must be remembered that training is not necessarily the only? or even the preferred solution to the various problems associated with SD. Nevertheless, where training can help, it must be regarded as the most readily applied control. The most specific enhancement identified was to make SD training more 'experienced-based.' This essentially implies more simulator and in-flight demonstrations and better SD preventive and management procedures.
Author
Aerospace Medicine; Disorientation; Psychological Effects; Human Factors Engineering; Flight Simulators; Education; Rotary Wing Aircraft

20000011739 Royal Norwegian Inst. of Aviation Medicine, Oslo, Norway
A SYSTEMS APPROACH TO SELECTION AND TRAINING OF AIRCREW TO THE AIR AMBULANCE SERVICE
Fonne, Vivianne, Royal Norwegian Inst. of Aviation Medicine, Norway; Myhre, Grete, Royal Norwegian Inst. of Aviation Medicine, Norway; Current Aeromedical Issues in Rotary Wing Operations; August 1999, pp. 4-1 - 4-5; In English; See also 20000011735; Copyright Waived; Avail: CASI; A01, Hardcopy; A03, Microfiche

Emergency Medical Services are recognized world wide for its highly qualified personnel, well known for their dedication and motivation to the service. Even so, regulatory practice in Air Ambulance Services varies from country to country offering different solutions to the issues of crew composition and qualification in order to ensure safe and efficient operations. The definition of crew and issues of selection and training from a systems perspective, involves in-depth discussions on the relative impact of regulatory, as well as organizational practices. One argues the need for greater regulatory commitment in developing criteria for selection and training of aircrew to the service. In addition, one suggests that in order to arrive at A,ell documented criteria in which all can agree, it is considered vital to involve all parts of the system in this process. Secondly, the question is raised whether one should be limited to a dedicated service for primary and secondary aeromedical transportation or whether one should allow for other non-medical transport missions as well. The choice of operational model will have obvious consequences for the crew concept chosen. The role of new technology in increasing safety in the Air Ambulance Service is included in the discussion, particularly in relation to choice of operational model, choice of crew composition as well as in relation to crew training requirements.
Author
Aerospace Medicine; Flight Crews; Air Transportation; Medical Services; Human Factors Engineering

20000011745 Textron Bell Helicopter, Fort Worth, TX USA
AN ANALYSIS OF THE IMPACT OF CHEMICAL/BIOLOGICAL WARFARE ENVIRONMENTS ON AVIATION CREWMEMBER COCKPIT PERFORMANCE
Taylor, Robert R., Textron Bell Helicopter, USA; Current Aeromedical Issues in Rotary Wing Operations; August 1999, pp. 12-1 - 12-11; In English; See also 20000011735; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

In 1995 and 1996 Bell Helicopter Textron conducted studies to determine the effect of NBC environments on aircraft cockpits and on aircrew performance. Two of the studies concentrated on: 1. Determining the build up rates inside small non hardened helicopter cockpits and 2. Determining the effects of the chemical protective clothing individual components on aircrew performance. The first study was used to determine the performance requirements for chemical detection systems. The second study was used to identify the short comings of existing chemical suits used by aviators and quantify those shortcomings in order to recommend improvements in future designs. The studies were intended to be generic in nature and apply to non-hardened scout type aircraft. The first study used the cockpit specifications and ventilation systems of a Jet Ranger type aircraft to determine the expected build up rates of chemical agents in the cockpit given a specific exterior contamination level. The task lists and manuals for the OH58 D Kiowa helicopter were used to provide input data for the Task and Workload analysis in the second study. The build up study determined the rate at which agent built up in the cockpit These data were plotted against the casualty effects of the specific agent as reported in standard military field manuals, and the exposure times were used to calculate the sensor response time requirements. The requirements were for the sensors to provide the crew adequate warning in both point and remote sensing modes. If adequate warning can be provided, aircrews can fly into suspected contamination areas in a lower protective posture and, as the warning is provided, they can maneuver to avoid the contamination or increase the personal protection to a higher level. For example, the crew may fly with protective mask off and the protective suit open to provide cooling and until the moment the protection is required. This capacity can improve both mission endurance and crew efficiency. This paper reports briefly the methodology used and the expected effects of one specific agent, and reports in detail on the methodology and the results of a human performance modeling analysis.
Derived from text
Chemical Warfare; Protective Clothing; Workloads (Psychophysiology); Cockpits; Human Factors Engineering; Aircraft Pilots; Human Performance

20000011748 Army Aeromedical Research Lab., Fort Rucker, AL USA
ASSESSMENT OF SIMULATED SPATIAL DISORIENTATION SCENARIOS IN TRAINING US ARMY AVIATORS
Johnson, P. A., Army Aeromedical Research Lab., USA; Estrada, A., Army Aeromedical Research Lab., USA; Braithwaite, M. G., Headquarters Army Aviation, UK; Manning, J. C., Army Aeromedical Research Lab., USA; Current Aeromedical Issues in Rotary Wing Operations; August 1999, pp. 15-1 - 15-6; In English; See also 20000011735; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

Spatial disorientation (SD) is considered to be present when a pilot fails to perceive the position, motion, or attitude of his/her aircraft with respect to the gravitational vertical or surrounding objects. The results of SD in flight may be disastrous. The limitation of ground based training to raise the aviator's awareness of SD is widely acknowledged. A proposal was therefore raised to develop SD scenarios for presentation in a visual flight simulator. The scenarios were developed using accident summaries from the US Army Safety Center (USASC), Fort Rucker Alabama, which were reviewed for suitable content. These were then presented as a series of scripts from which a trainer could reproduce the situation in a visual flight simulator. The resulting scenarios were presented to 30 experienced aviators who completed questionnaire evaluations after each scenario and an overall evaluation. The results showed a high level of acceptance of this training tool by a group of experienced aviators with differing backgrounds. The scenarios have since been developed as a U.S. Army aviation training tool and are being distributed to units worldwide. The scenarios were developed in a UH-60 (Blackhawk) simulator, but have been refined to make them relevant to other types of helicopter operation, such as the AH64 (Apache) attack helicopter

Author

Flight Simulators; Aircraft Pilots; Disorientation; Human Factors Engineering; Education; Aerospace Medicine; Armed Forces (United States)

20000011750 Centro de Instruccion de Medicina Aeroespatial, Madrid, Spain

FEAR OF FLYING IN SPAF HELICOPTER AIRCREW

Cruz, Jesus Medialdea, Centro de Instruccion de Medicina Aeroespatial, Spain; Tejada, Francisco Rios, Centro de Instruccion de Medicina Aeroespatial, Spain; Current Aeromedical Issues in Rotary Wing Operations; August 1999, pp. 17-1 - 17-6; In English; See also 20000011735; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

In this retrospective work have studied Fear of Flying in a group of SPAF Spanish Air Force) helicopter aircrew. We analyze the frequency of phobia to flight, its relation with aircraft accidents and flight motivation, as well as the presence of other psychiatric diseases and therapeutic attitudes.

Author

Fear Of Flying; Flight Crews; Human Factors Engineering; Aerospace Medicine; Helicopters

20000011751 Army Aeromedical Research Lab., Fort Rucker, AL USA

ASSESSMENT OF AIRCREW STRESS

Katz, Lawrence C., Army Aeromedical Research Lab., USA; Current Aeromedical Issues in Rotary Wing Operations; August 1999, pp. 18-1 - 18-5; In English; See also 20000011735; Copyright Waived; Avail: CASI; A01, Hardcopy; A03, Microfiche

The belief systems associated with the aviator personality may not be optimal for coring with interpersonal stresses, and thus could be the target of intervention in a proactive attempt to prevent the 'failing aviator' syndrome. This study assessed members of a U.S. Army medical evacuation unit in terms of their stressors, current coping styles, thought patterns, and symptoms suggesting difficulties in coping. Respondents' perceived lack of work rewards, ongoing relational pressures, pessimism and resentment were found to be related to physical, emotional, and behavioral symptoms. This study suggests a potential preventative approach to stress management training with military aviators using cognitively oriented interventions.

Author

Human Factors Engineering; Emotional Factors; Stress (Psychology); Aerospace Medicine; Flight Crews; Aircraft Pilots

20000011759 Army Aeromedical Research Lab., Aircrew Health and Performance Div., Fort Rucker, AL USA

SIMULATOR VERSUS IN-FLIGHT MEASUREMENT OF PILOT PERFORMANCE

Caldwell, J. A., Army Aeromedical Research Lab., USA; Roberts, K. A., Army Aeromedical Research Lab., USA; Jones, H. D., Army Aeromedical Research Lab., USA; Current Aeromedical Issues in Rotary Wing Operations; August 1999, pp. 27-1 - 27-7; In English; See also 20000011735; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

A quasi-experimental approach assessed the comparability of simulator versus in-flight results. Flight data from three sleep deprivation studies were pooled. Twenty aviators were included, 10 who flew a UH-60 helicopter simulator and 10 who flew a UH-60A aircraft under the influence of Dexedrine, or placebo during 40 hours of continuous wakefulness. Performance on straight and levels, right and left turns, climbs and descents, and a left-descending turn (assessed at 0100, 0500, 0900, 1300, and 1700) tended to correspond in the simulator and aircraft. Generally, performance under Dexedrine was better than under placebo. However, only half of the maneuvers showed consistent, statistically significant stimulant/fatigue effects in both flight platforms. Measurement sensitivity was lower in the aircraft, likely because of error variance due to environmental influences (weather, temperature, and turbulence) and other factors (radio traffic and anxieties about safety). Thus, actual in-flight studies, while desirable in terms of face-validity, underestimate the impact of stressors such as fatigue on pilots.

Author

Pilot Performance; In-Flight Monitoring; Computerized Simulation; Aerospace Medicine; Sleep Deprivation; Aircraft Pilots; Human Factors Engineering

20000011760 Army Aeromedical Research Lab., Aircrew Health and Performance Div., Fort Rucker, AL USA

THE EFFECTS OF EXERCISE VERSUS NAPPING ON ALERTNESS AND MOOD IN SLEEP-DEPRIVE AVIATORS

LeDuc, P. A., Army Aeromedical Research Lab., USA; Caldwell, J. A., Army Aeromedical Research Lab., USA; Ruyak, P. S., Army Aeromedical Research Lab., USA; Current Aeromedical Issues in Rotary Wing Operations; August 1999, pp. 28-1 - 28-10; In English; See also 20000011735; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

A quasi-experimental approach assessed the comparability of exercise versus napping for maintaining alertness in aviators deprived of sleep. Subjective and objective data from two sleep-deprivation studies were pooled. Thirty aviators were included, 18 who were given zolpidem induced naps during the deprivation period and 12 who exercised during 40 hours of continuous wakefulness. Performance on Repeated Tests of Sustained Wakefulness, Profile of Mood State questionnaires, and Visual Analogue Scales was assessed. Zolpidem- induced naps were superior to rest in sustaining mood, and alertness on both a subjective and objective test. Napping was also clearly better than exercise for attenuating changes in mood and subjective alertness typically produced by sleep loss.

Author

Sleep Deprivation; Physical Exercise; Alertness; Aircraft Pilots; Human Factors Engineering; Analogs; Sports Medicine

20000032670 Brigham and Women's Hospital, Boston, MA USA

THE DEPLOYMENT OF VISUAL ATTENTION: TWO SURPRISES

Wolfe, Jeremy M.; Search and Target Acquisition; March 2000, pp. 20-1 - 20-11; In English; See also 20000032651; Copyright Waived; Avail: CASI; A03, Hardcopy

The visual system is not capable of processing of all aspects of a scene in parallel. While some visual information can be extracted from all locations at once, other processes, including object recognition, are severely limited in their capacity. Selective attention is used to limit the operation of these limited-capacity processes to one (or, perhaps, a few) objects at a time. Searching for a target in a scene, therefore, requires deployment of attention from one candidate target to the next until the target is found or the search is abandoned. Common-sense suggests that distractor objects that have been rejected as targets are marked in some fashion to prevent redeployment of attention to non-target items. Introspection suggests that sustained attention to a scene builds up a perception of that scene in which more and more objects are simultaneously recognized. Neither common-sense nor introspection are correct in this case. Evidence suggests that covert attention is deployed at random among candidate targets without regard to the prior history of the search. Rejected distracters are not marked during a search. Prior to the arrival of attention, visual features are loosely bundled into objects. Attention is required to bind features into a recognizable object. For an object to be recognized, there must be a link between a visual representation and a representation in memory. Our data suggest that only one such link can be maintained at one moment in

time. Hence, counter to introspection, only one object is recognized at one time. These surprising limits on our abilities may be based on a trade off speed for apparent efficiency.
Author
Visual Perception; Target Recognition; Visual Observation; Position (Location); Pattern Recognition; Mental Performance

20000032672 Army Research Lab., White Sands Missile Range, NM USA
DEPTH PERCEPTION APPLIED TO SEARCH AND TARGET ACQUISITION
Watkins, Wendell R., Army Research Lab., USA; Alaways, LeRoy, Military Academy, USA; Search and Target Acquisition; March 2000, pp. 22-1 - 22-11; In English; See also 20000032651; Copyright Waived; Avail: CASI; A03, Hardcopy

A search and target acquisition test was performed under an exchange scientist program with the TNO Human Factors Research Institute at Soesterberg, The Netherlands in September 1998. The test was performed at a military training base using several of the scientists from TNO wearing Dutch forest camouflage uniforms. Sets of wide baseline stereo photos were obtained for targeted and non-targeted scenes at two sites. The targeted and non-targeted scene photos were taken on the same day within a few minutes of each other. The imagery obtained was taken with a 35 mm camera with a 200 mm lens for target ranges from 100 m to 1 km. A single field of view was used for all of the targeted and non-targeted scenes at each site. The photos were taken with color slide film and were digitized to 3K by 2K pixel resolution. These imagery data sets were used to perform search and target acquisition tests. Preliminary analysis of single line of sight search and target acquisition observer tasks was performed for the same scenes with and without targets. Results of these observer tests are presented. Additionally, the scenes used in these tests were made into stereo pair images for observer display. There are several aspects to the display of wide baseline stereo images that must be taken into consideration for optimum depth perception for use in search and target acquisition. Rule of thumb guidelines for optimizing the depth perception of the contour of camouflaged targets versus terrain features have been derived.
Author
Space Perception; Target Acquisition; Camouflage; Photographs; Target Recognition; Stereoscopic Vision; Visual Discrimination; Visual Observation

20000032686 Institut de Medicine Aerospatiale Armee, Dept. Sciences Cognitives, Bretigny sur Orge, France
PSYCHOLOGICAL CONSEQUENCES AND PILOT 'SITUATIONAL AWARENESS' SURVEY
Grau, J. Y., Institut de Medicine Aerospatiale Armee, France; Human Consequences of Agile Aircraft; March 2000, pp. 3 - 1 - 3 - 15; In English; See also 20000032683; Copyright Waived; Avail: CASI; A03, Hardcopy

The technological design and developments already applied to a number of aircraft, which represent the basis of tomorrow's aircraft, tend to change the tasks performed by pilots. Since the 80's, automation and computerization have invaded cockpits, leading to a change in the role of pilots. Whereas pilots used to need competencies directed towards handling and navigating the aircraft, what is now increasingly required of them is the ability to manage complex systems. With the arrival of new concepts like supermaneuverability and superagility, it seems extremely important to try and understand the psychological consequences these concepts will have on pilots. Enabling new types of operation, supermaneuverability and superagility alter existing tasks and will probably create new ones, which will have their own psychological constraints. What makes these constraints different from those existing on present aircraft, and what consequences could they have on pilot performance? These two questions can be addressed by two preliminary comments: (1) As of today, supermaneuverability and superagility are still extremely novel concepts. Various 'prototype' aircraft point to the developments, which will eventually make these concepts a reality in the near future, but there still is no such thing as 'real' operational experience. The difficulty in accurately studying the consequences these future aircraft will have on pilots, lies in trying to define the exact role the pilot will be asked to play aboard. (2) The psychological consequences studied in this chapter will be limited to the consequences borne by the pilot in terms of taking and processing information. This chapter does not take into account psychological aspects based on personality or motivation.
Derived from text
Aircraft Pilots; Human-Computer Interface; Pilot Performance; Flight Fatigue; Stress Analysis; Human Factors Engineering

20000032689 Swedish Air Force, Aeromedical Center, Stockholm, Sweden
SELECTION, TRAINING AND SIMULATION
Linder, Jan, Swedish Air Force, Sweden; Tielemans, W., Swedish Air Force, Sweden; Albery, W., Swedish Air Force, Sweden; Human Consequences of Agile Aircraft; March 2000, pp. 6 - 1 - 6 - 10; In English; See also 20000032683; Copyright Waived; Avail: CASI; A02, Hardcopy

In this paper a 'superagility training structure' has been discussed and proposed. The super agile pilot will in the new superagility arena be clearly dependent on both old training principles but also on training where some new interacting factors might come into play: (1) At first Selection plays a major role with physiological, intellectual and stress management resources; (2) Certain human constraints like musculoskeletal, cardiovascular, respiratory, sensory and mental are discussed;(3) Normal life and regular training where almost everything the pilot does also have a definite implication also on flying; (4) Specific single task training where a pilot trains crucial abilities like G-tolerance, back/neck tolerance and so on. Today there is a lack in this area of specific training. There is also a need for training devices for pilots regarding the sensory system and the cognitive performance; (5) Specific combined tasks training where the pilot have to train in a more complex way, e.g. survival training or mission scenarios in a Multi Mission Trainer (MMT; and (6) Full ground mission task where the pilot uses a Full Mission Simulator (FMS) or a Dynamic Flight Simulator (DFS). Some parts of the Superagility Training Structure have not been a scope of this paper. They are Basic flying and Tactical/operational flying.
Derived from text
Pilot Selection; Physiological Tests; Flight Simulation; Pilot Training; Human Factors Engineering; Flight Fatigue; Flight Stress (Biology); Pilot Performance

20000033304 Institut de Medicine Aerospatiale Armee, Bretigny sur Orge, France
THE USE OF MODAFINIL IN OPERATIONAL SETTINGS: INDIVIDUAL DIFFERENCES IMPLICATIONS
LaGarde, Didier, Institut de Medicine Aerospatiale Armee, France; Individual Differences in the Adaptability to Irregular Rest-Work Rhythms/Status of the Use of Drugs in Sleep-Wakefulness Management; March 2000, pp. 1 - 1 - 1 - 4; In English; See also 20000033303; Copyright Waived; Avail: CASI; A01, Hardcopy

Disruptions in wake-sleep rhythms, particularly induced by SUSOPS and CONOPS, are limiting factors for military personnel in operation. Pharmacological aids, such as hypnotic or stimulant substances can be effective countermeasures. Modafinil (MODIODAL PROVIGIL is a synthetic molecule prescribed for the treatment of narcolepsia and idiopathic hypersomnia. The wakening effect is potent : modafinil allows healthy volunteers to stay awake and efficient for more than 60 hours, without side effects. Its mechanism of action is complex, and it could induce wakefulness by different mechanisms., as compared with other classical vigilance enhancing drugs such as amphetamines. A neuroprotective effect against neurotoxic organophosphate agents was recently discovered. Modafinil seems to be a powerful and safe countermeasure in the management of sleep-wake rhythm during operational situations.
Author
Military Operations; Amphetamines; Organic Phosphorus Compounds; Personnel

20000033308 Defence Evaluation Research Agency, Protection and Performance Dept., Farnborough, UK
PROMOTING SLEEP: ADAPTING TO SHIFTWORK AND TIME ZONE CHANGE
Stone, Barbara M., Defence Evaluation Research Agency, UK; Individual Differences in the Adaptability to Irregular Rest-Work Rhythms/Status of the Use of Drugs in Sleep-Wakefulness Management; March 2000, pp. 5 - 1 - 5 - 11; In English; See also 20000033303; Copyright Waived; Avail: CASI; A03, Hardcopy

The changes in performance that arise in shiftworkers and after

transmeridian flights can be attributed, at least in part, to the reduction in both the quality and quantity of sleep which occurs as a result of disruption of the normal pattern of sleep and wakefulness. Sleep disturbance associated with shiftwork is well documented (1-4). Sleep during the day is shorter and more disturbed than sleep at night, and it has been estimated that, by the end of a week of night duty, the equivalent of at least one night's sleep may have been lost (5). While the duration of slow-wave sleep is unchanged following the night shift, due to prior wakefulness, stage 2 and rapid eye movement (REM) sleep are reduced. Further, in shiftworkers over about 40 years old, the usual decline in sleep quality and quantity with increasing age exacerbates the problems associated with an unusual pattern of work and rest (6-8). This age-related difference in sleep is also evident in studies of transmeridian travel (9).
Author
Sleep; Sleep Deprivation; Wakefulness

20000033310 Institute for Human Factors TNO, Soesterberg, Netherlands
THE EFFECTS OF TYROSINE ON COGNITIVE FUNCTIONS DURING SUSTAINED OPERATIONS
Wientjes, Cornelis J. E., Institute for Human Factors TNO, Netherlands; Deijen, J. Berend, Vrije Univ., Netherlands; Vullinghs, Huub F. M., Royal Netherlands Army, Netherlands; Individual Differences in the Adaptability to Irregular Rest-Work Rhythms/Status of the Use of Drugs in Sleep-Wakefulness Management; March 2000, pp. 7 - 1 - 7 - 8; In English; See also 20000033303; Copyright Waived; Avail: CASI; A02, Hardcopy

The effect of supplementation of the amino acid L-tyrosine on cognitive task performance was assessed during a highly demanding two-week combat training course. A tyrosine group (10 subjects) received daily doses of a protein-rich drink (containing 2 g tyrosine), while a placebo group (11 subjects) received the same doses of a carbohydrate rich drink (containing no proteins). Cognitive task performance was evaluated immediately preceding the course, as well as at the end of the first week of the course. Although there were no group differences in task performance prior to the course, the tyrosine group clearly performed better than the placebo group on several cognitive performance tasks during the course. Overall, up to 40% of the cognitive performance decrement that was due to die impact of stress and fatigue, was counteracted by the supplementation of tyrosine. The findings suggest that tyrosine supplementation can be effective in preventing cognitive degradation in highly demanding military operational environments that include sustained operations, as well as physical and psychological stressors.
Author
Tyrosine; Military Operations; Human Performance; Amino Acids; Cognition

20000033311 Aeromedical Inst., Soesterberg, Netherlands
SLEEP AND ALERTNESS MANAGEMENT DURING MILITARY OPERATIONS: QUESTIONS TO BE ANSWERED
Simons, M., Aeromedical Inst., Netherlands; Valk, P. J. L., Aeromedical Inst., Netherlands; Individual Differences in the Adaptability to Irregular Rest-Work Rhythms/Status of the Use of Drugs in Sleep-Wakefulness Management; March 2000, pp. 8 - 1 - 8 - 8; In English; See also 20000033303; Copyright Waived; Avail: CASI; A02, Hardcopy

Sleep and alertness management is a major point of attention for the medical support of military round the clock operations. Crew's awareness on the effects of fatigue and sleepiness should be enhanced. Flight surgeons should be trained on the use of practical methods to prevent serious fatigue and to enhance performance and alertness of the crew. Although. in civil and in military aviation a considerable number of studies have been conducted on fatigue countermeasures and preventive strategies, results are not readily available for practical use by flight surgeons. In order to develop useful guidelines for flight surgeons and crew, the international aeromedical research community should be able to produce a database on what is already known and identify areas where knowledge is lacking. In this context research questions related to the use of strategic naps, hypnotics, stimulants, and chronobiotic treatment are put forward.
Author
Sleep; Alertness; Military Operations; Fatigue (Biology)

20000033313 Portuguese Air Force Aeromedical Center, Training and Flight Safety Dept., Lisbon, Portugal
PORTUGUESE AIR FORCE AEROMEDICAL CENTRE APPROACH TO MANAGEMENT OF SLEEP/WAKEFULNESS OF AIRCREW
Ribeiro, Nuno Pedro, Portuguese Air Force Aeromedical Center, Portugal; Individual Differences in the Adaptability to Irregular Rest-Work Rhythms/Status of the Use of Drugs in Sleep-Wakefulness Management; March 2000, pp. 10 - 1 - 10 - 3; In English; See also 20000033303; Copyright Waived; Avail: CASI; A01, Hardcopy

The first time we noticed that we had a problem with the lack of guidelines to manage the sleep/wakefulness disturbances among aircrew was during the time we had a P3-P stationed in Sigonnela (IT) flying integrated in a NATO force. They were there during periods of 15 days flying following a schedule that we can see an example in Figure 1. According to this we sent there a flight surgeon that detected two major problems: the lack of regularity on shiftwork and overworkload. We have to add to the hours we can see in the example, 3) more hours of pre-flight briefing and two hours of debriefing, all with only one crew. An additional problem was the location of the rooms of the NCOs, either air crewmembers or ground crew-members, situated near the flight line, submitted to high levels of noise and very difficult to get dark enough during the day, limiting a good or sufficient period of sleep. All the personnel had difficulty to get alcoholic beverages or exercise near exhaustion.
Author
Aerospace Medicine; Flight Crews; Wakefulness; Sleep

20000033314 Aeronautica Militare Italiana, Reparto Medicina Aerospaziale, Rome, Italy
SLEEP TENDENCY AND ABILITY TO SUSTAIN WAKEFULNESS
Porcu, Silvio, Aeronautica Militare Italiana, Italy; Casagrande, Maria, Aeronautica Militare Italiana, Italy; Ferrara, Michele, Aeronautica Militare Italiana, Italy; Individual Differences in the Adaptability to Irregular Rest-Work Rhythms/Status of the Use of Drugs in Sleep-Wakefulness Management; March 2000, pp. 11 - 1 - 11 - 6; In English; See also 20000033303; Copyright Waived; Avail: CASI; A02, Hardcopy

During sustained military operations it is often necessary to cope with prolonged periods of wakefulness and irregular rest-activity patterns. In these situations a severe sleep debt can accumulate, leading to increasing levels of sleepiness on the job and, consequently, to dangerous decreases of performance. A number of possible pharmacological and nonpharmacological countermeasures have been studied. Prophylactic naps (short periods of sleep before long periods of work) are probably the best non-pharmacological tool to reduce fatigue and improve performance (e.g., Bonnet, 1991). They have to take place according to some 'chronobiological rules': for example., it is well known that sleep propensity shows a biphasic distribution, with an early morning (5.30-7.30 hours) and a mid afternoon (15.30) peak, defined 'primary and secondary sleep gates' by Lavie (1986). In addition, naps should be scheduled before the accumulation of a severe sleep debt and placed far from the circadian through of body temperature rhythm in order to minimize sleep inertia effects (e.g., Dinges, Orne Orne, 1985).
Author
Sleep; Wakefulness; Military Operations; Circadian Rhythms

20000033315 Polish Air Force Inst. of Aviation Medicine, Inst. of Psychiatry and Neurology, Warsaw, Poland
USEFULNESS OF SLEEP RECORDS AFTER MILD HEAD TRAUMA TO PREDICT SHIFT WORK EFFECTIVENESS
Maksymiuk, Grzegorz, Polish Air Force Inst. of Aviation Medicine, Poland; Jernajczyj, Wojciech, Polish Air Force Inst. of Aviation Medicine, Poland; Individual Differences in the Adaptability to Irregular Rest-Work Rhythms/Status of the Use of Drugs in Sleep-Wakefulness Management; March 2000, pp. 12 - 1 - 12 - 6; In English; See also 20000033303; Copyright Waived; Avail: CASI; A02, Hardcopy

Validity of polysomnography for determining the post-traumatic sequelae was evaluated in 33 male patients after a mild head trauma. The results indicate that shortly after the trauma accompanied by the brain commotion disturbances in sleep architecture can be detected by means of polysomnography. We also demonstrate that polysomnography is a sensitive method of evaluation of early post-traumatic alterations within the CNS. Based on the results of the

present study we conclude that the described diagnostic procedure should become a steady element of the clinical evaluation and qualification of patients presenting with subjective symptoms as the sequelae of a mild head trauma.
Author
Sleep Deprivation; Signs And Symptoms; Central Nervous System; Records

20000033316 Interior Dept., Center of Neurology and Medical Psychology, Genoa, Italy
SLEEPINESS IN A POPULATION OF ITALIAN SHIFT-WORK POLICEMEN
Garbarino, S., Interior Dept., Italy; Nobili, L., Genoa Univ., Italy; Balestra, V., Genoa Univ., Italy; Beelke, M., Genoa Univ., Italy; DeCarli, F., National Council of Research, Italy; Cordelli, A., Interior Dept., Italy; Ferrillo, F., Genoa Univ., Italy; Individual Differences in the Adaptability to Irregular Rest-Work Rhythms/Status of the Use of Drugs in Sleep-Wakefulness Management; March 2000, pp. 13 - 1 - 13 - 4; In English; See also 20000033303; Copyright Waived; Avail: CASI; A01, Hardcopy

Various studies have shown that sleep disorders and daytime sleepiness are the more frequent disturbances reported by shiftworkers (1,2). Shift-work interferes. with both the quality and quantity of sleep. Concerning the duration of sleep, there is a decrease in the number of hours of sleep both during morning shifts, due to early awakening, and during night shifts due to the inversion of the normal sleep-wake cycle (3). The increase in body temperature, observed starting from the early morning hours, and the unfavorable environmental conditions (noise, family and social life, etc.) make it more difficult to fall asleep during the day (4,5). Data reported in the literature show how sleepiness and fatigue can increase the risk of human errors and accidents (6,7). Night work and loss of sleep may account for some recent serious accidents (Three-Mile Island 1979, Chernobyl 1986, Exxon Valdez 1989).
Author
Sleep; Populations; Errors; Sleep Deprivation; Personnel

20000033317 Italian Air Force Pratica di Mare, Aerospace Medicine Dept., Rome, Italy
SLEEP INERTIA AND ON-CALL READINESS
Ferrara, Michele, Italian Air Force Pratica di Mare, Italy; Casagrande, Maria, Italian Air Force Pratica di Mare, Italy; Porcu, Silvio, Italian Air Force Pratica di Mare, Italy; DeGennaro, Luigi, Rome Univ., Italy; Bertini, Mario, Rome Univ., Italy; Individual Differences in the Adaptability to Irregular Rest-Work Rhythms/Status of the Use of Drugs in Sleep-Wakefulness Management; March 2000, pp. 14 - 1 - 14 - 7; In English; See also 20000033303; Copyright Waived; Avail: CASI; A02, Hardcopy

The effects of sleep deprivation and chronobiological variations in performance are undoubtedly among the most pervasive limiters of human ability in all situations that require sustained periods of continuous performance and in around-the-clock work settings (e.g. Dinges et al., 1988). These work scenarios are becoming increasingly common, often involving highly skilled and dedicated personnel as in sustained military operations, space flight preparation and launching, crisis and catastrophe management (Mitler et al., 1988). In all these situations, the negative effects of sleep loss during sustained operations must be compared to the adverse effects of sleep inertia upon abrupt awakening from sleep due to a possible emergency (Dinges et al., 1988; Dinges, 1990).
Author
Sleep; Inertia; Military Operations; Personnel; Sleep Deprivation

20000033318 Institut de Medicine Aerospatiale Armee, Bretigny sur Orge, France
INFLUENCE OF AGE AND GENDER ON JET-LAG SYNDROME: RECOMMENDATIONS
Lagarde, Didier, Institut de Medicine Aerospatiale Armee, France; Beaumont, Maurice, Institut de Medicine Aerospatiale Armee, France; Batejat, Denise, Institut de Medicine Aerospatiale Armee, France; Catrycke, Marc, Institut de Medicine Aerospatiale Armee, France; VanBeers, Pascal, Institut de Medicine Aerospatiale Armee, France; French, Jonathan, Armstrong Lab., USA; Individual Differences in the Adaptability to Irregular Rest-Work Rhythms/Status of the Use of Drugs in Sleep-Wakefulness Management; March 2000, pp. 15 - 1 - 15 - 3; In English; See also 20000033303; Copyright Waived; Avail: CASI; A01, Hardcopy

Jet-lag syndrome in civilian flight personnel is quite well known. In Air Force crews, especially during longhaul flights, jet-lag is associated with sleep deprivation and a specific environment. In this communication., we present some results of a real world experiment (simulation of troops deployment) after a transmeridian flight in which we evaluated notably the influence of age and gender in this kind of jet-lag. In our population, composed of 27 US Air Force reservists, males and females from 19 to 46 years old, we did not find any important differences due to age and/or gender. Only subjective data, recorded from Sleep Log, presented statistical differences. Nevertheless in the global population the jet-lag induced disturbances in 33% of the studied parameters. Some physiological and/or pharmacological recommendations are done.
Author
Age Factor; Jet Lag; Signs And Symptoms; Sleep Deprivation; Sex Factor

20000033319 Dortmund Univ., Inst. for Occupational Physiology, Germany
THE ADAPTABILITY OF INDIVIDUALS TO SHIFTWORK: A POSSIBLE EXPERIMENTAL APPROACH
Griefahn, Barbara, Dortmund Univ., Germany; Degen, Gisela, Dortmund Univ., Germany; Blaszkewicz, Meinolf, Dortmund Univ., Germany; Golka, Klaus, Dortmund Univ., Germany; Kuenemund, Christa, Dortmund Univ., Germany; Their, Ricarda, Dortmund Univ., Germany; Individual Differences in the Adaptability to Irregular Rest-Work Rhythms/Status of the Use of Drugs in Sleep-Wakefulness Management; March 2000, pp. 18 - 1 - 18 - 6; In English; See also 20000033303; Copyright Waived; Avail: CASI; A02, Hardcopy

The Institute for Occupational Physiology at the University of Dortmund has been an important research center for shiftwork. This line of research was terminated a decade ago, when Joseph Rutenfranz died in 1989 and Peter Knauth became Professor at the University of Karlsruhe. Now, this topic will be resumed by a scientist with an extended experience in sleep research focused on experimental studies and field observations on sleep disturbances as caused by environmental noise [10, 11]. Research on shiftwork now will be executed in close cooperation with the biochemical unit of the institute.
Author
Adaptation; Personnel; Biochemistry

20000033320 Army Aeromedical Research Lab., Fort Rucker, AL USA
NAPPING STRATEGIES TO COUNTERACT SLEEP DEPRIVATION
Caldwell, J. Lynn, Army Aeromedical Research Lab., USA; Individual Differences in the Adaptability to Irregular Rest-Work Rhythms/ Status of the Use of Drugs in Sleep-Wakefulness Management; March 2000, pp. 19 - 1 - 19 - 11; In English; See also 20000033303; Copyright Waived; Avail: CASI; A03, Hardcopy

There is an abundance of evidence indicating that a nap taken during long periods of otherwise continuous wakefulness is extremely beneficial for improving alertness and performance. However, scheduling naps is not a simple matter. Several factors are important to consider before implementing a napping regime into a continuous operations scenario.
Author
Alertness; Sleep Deprivation; Wakefulness

20000033321 Norwegian Defence Research Establishment, Kjeller, Norway
POLYPHASIC SLEEP AND NAPPING STRATEGIES
Opstad, Per Kristian, Norwegian Defence Research Establishment, Norway; Individual Differences in the Adaptability to Irregular Rest-Work Rhythms/Status of the Use of Drugs in Sleep-Wakefulness Management; March 2000, pp. 20 - 1 - 20 - 2; In English; See also 20000033303; Copyright Waived; Avail: CASI; A01, Hardcopy

Sleep deprivation is the most detrimental stress factor for mental performance during continuous military operations. First of all it affects all subjective parameters such as well-being, mood state, motivation, creativity, care for others or social surplus. These changes are followed by alterations in psychometric performance tests such as vigilance tasks, with increasing number of omissions, complex tasks, cognitive functions, reduced reaction speed and

learning capacity. When sleep is totally denied for several days more serious neurological symptoms appear such as slow motion, balance disturbance, nystagmus, headache, visual hallucination and sleep narcosis. All this symptoms are most apparent during night-time.
Author
Sleep Deprivation; Human Performance; Mental Performance; Military Operations; Alertness; Stress (Biology)

20000033322 Aeronautica Militare Italiana, Reparto Medicina Aeroapaziale, Rome, Italy
ASSESSING THE ADAPTABILITY TO IRREGULAR REST-WORK RHYTHMS IN MILITARY PERSONNEL
Porcu, Silvio, Aeronautica Militare Italiana, Italy; Casagrande, Maria, Aeronautica Militare Italiana, Italy; Ferrara, Michele, Aeronautica Militare Italiana, Italy; Individual Differences in the Adaptability to Irregular Rest-Work Rhythms/Status of the Use of Drugs in Sleep-Wakefulness Management; March 2000, pp. 21 - 1 - 21 - 5; In English; See also 20000033303; Copyright Waived; Avail: CASI; A01, Hardcopy

Operational decreases in performance resulting from sleep deprivation or irregular sleep-wake patterns are well known and are becoming increasingly important in today's industrialized society. Excessive sleepiness at unusual hours is estimated to affect approximately 5% of the general population and is associated with increased morbidity, loss of work hours, reduced productivity, increased work errors and impaired social and family relationship. In addition, there is an increased mortality risk when sleepiness affects motor vehicle and train drivers, aircraft pilots, nuclear power workers, and, generally, people involved in crucial occupations (e.g. Mittler, Carskadon, Czeisler, Demerit, Dinges, Curtis, Graeber, 1988).
Author
Adaptation; Personnel; Productivity; Estimating; Sleep Deprivation

20000033323 Kaunas Medical Univ., Inst. of Psychophysiology and Rehabilitation, Kaunas, Lithuania
ANALYSIS OF HEART RATE VARIABILITY DURING SLEEP AS A TOOL FOR ASSESSMENT OF CARDIOVASCULAR ADAPTABILITY AND FATIGUE IN SLEEP-WAKE CYCLE
Varoneckas, G., Kaunas Medical Univ., Lithuania; Individual Differences in the Adaptability to Irregular Rest-Work Rhythms/Status of the Use of Drugs in Sleep-Wakefulness Management; March 2000, pp. 22 - 1 - 22 - 7; In English; See also 20000033303; Copyright Waived; Avail: CASI; A02, Hardcopy

An assessment of general adaptation reserve of cardiovascular function by means of heart rate (HR) and HR variability analysis during sleep and functional tests is demonstrated. A possibility to evaluate a restoration of cardiovascular reserve after sleep by means of HR changes during active orthostatic test is shown. The level of autonomic HR control and balance of sympathetic-parasympathetic inputs might be measured by means of analysis of HR power spectrum main oscillatory components. The differences in cardiovascular reserve of healthy subjects and cardiac patients, as well as possibility of HR restoration during sleep was demonstrated. In conclusion, adaptability of cardiovascular function and fatigue-restoration cycle might be assessed by means of very simple methodology - an analysis of HR Poincare maps. Its practical application in the cases of fatigue, developed during disturbed wake-sleep cycle or overtraining situation in high physical or emotional overcrowding is shown.
Author
Heart Rate; Sleep; Cardiovascular System; Adaptation; Fatigue (Biology)

20000092064 Research and Technology Organization, Human Factors and Medicine Panel, Neuilly-sur-Seine, France
KINGDOM IN THE SKY - EARTHLY FETTERS AND HEAVENLY FREEDOMS. THE PILOT'S APPROACH TO THE MILITARY FLIGHT ENVIRONMENT *[LE ROYAUME AU CIEL - FERS TERRESTRES ET LIBERTES CELESTES. LA DEMARCHE DU PILOTE VIS A VIS DE L'ENVIRONNEMENT AERONAUTIQUE OPERATIONNEL]*
Ponomarenko, V., Research and Technology Organization, France; Boubel, T., Editor, Research and Technology Organization, France; Ercoline, W., Editor, Research and Technology Organization, France; July 2000; 162p; In English; CD-ROM contains full text document in PDF format; Translator: I. Malinin
Report No.(s): RTO-AG-338; AC/323[HFM]TP/5; ISBN 92-837-1041-X; Copyright Waived; Avail: CASI; A08, Hardcopy; C01, CD-ROM

This book provides insight from a Russian perspective into the psychology of the flyers (pilot and other aircrew members), and their constant struggle to cope with the procedures dictated by ground-based directors while enjoying the thrill and emotional high of flight. The author takes the reader through the turmoil of flight emergencies, unpopular ground-directed missions, and, ultimately, aircraft mishaps. He describes the difficult conditions placed upon the flyers by a system inadequately prepared to address human factor issues, and points out that it is the responsibility of those on the ground to improve the conditions of the flyer. Those improvements can come from knowledge based on research and appreciation of the flyers' mission. Chapter 1 provides details of the problems associated with aircraft accident investigations and the impact these can have on the flyer's dignity. Chapter 2 describes many of the dangers associated with flight, as well as the skills necessary to overcome those hazards. Chapter 3 describes the current state of human factor issues and flight safety. Chapter 4 deals with ergonomics and their relationship with flight safety. Chapter 5 matches the role of the flight surgeon with the operational requirements of the flyers. Chapter 6 identifies the problems encountered when one is too conservative toward a profession that requires radical, rapid, and sometimes fatal in flight decisions. Chapter 7 explains how the flyer can maintain a healthy body and mind. Chapter 8 summarizes the research and lessons learned by the author while working with the flyer and within the establishment.
Author
Aircraft Accident Investigation; Flight Safety; Flight Crews; Aviation Psychology; Aircraft Accidents; Pilot Training; Russian Federation; Histories

20000098511 Assistant Secretary of Defense (Force Management and Personnel), Washington, DC USA
POLICIES, PROCEDURES, AND PEOPLE: THE INITIAL SELECTION OF US MILITARY OFFICERS
Arabian, Jane M., Assistant Secretary of Defense (Force Management and Personnel), USA; Shelby, Jennifer A., Air Force Academy, USA; Officer Selection; August 2000, pp. 1-1 - 1-7; In English; See also 20000098510; Copyright Waived; Avail: CASI; A02, Hardcopy

USA military officers come from all walks of life so it follows that the policies and procedures for selecting and training officer candidates were designed with that in mind. There are four primary sources of commissioning. Most officers are commissioned through college Reserve Officer Training Corps (ROTC) programs. ROTC is less regimented than the programs at the second type of commissioning source, the four U.S. military academies -- U.S. Military Academy, U.S. Naval Academy, U.S. Air Force Academy, and U.S. Coast Guard Academy - but has the same goals. Officer Training/Candidate School is a third type of commissioning source and serves as an adjustable 'valve' to augment the number of officers commissioned in each Service. Other programs, such as the Air Force's Leader Encouraging Airmen Development (LEAD), also exist and are designed to identify outstanding airmen for possible commissioning opportunities. The fourth source of officer commissioning is the direct commission, reserved for certain professionals (e.g., lawyers, physicians). Regardless of commissioning source, the U.S. military has high physical, academic, and moral character standards for individuals seeking to become a military officer. Rather than identify and select individuals for attributes, skills, and abilities needed at advanced officer grades, the U.S. military practices an 'up or out' philosophy wherein the training and selection of officers occurs throughout the course of a career.
Author
Armed Forces (United States); Personnel Selection; Policies; Procedures; Qualifications; Personality

20000098512 Ecole Polytechnique Federale, Swiss Military Coll., Switzerland
ACABO - THE ASSESSMENT CENTER FOR FUTURE PROFESSIONAL OFFICERS IN THE SWISS ARMY
Annen, Hubert, Ecole Polytechnique Federale, Switzerland; Officer Selection; August 2000, pp. 2-1 - 2-4; In English; See also 20000098510; Copyright Waived; Avail: CASI; A01, Hardcopy

Each future professional officer of the Swiss armed forces has to pass an assessment center even before he starts his studies at

the Military College. During this three day procedure his personality characteristics and social behaviour are observed and appraised by several trained assessors/observers. The paper describes the organizational and scientific bases of this procedure, it explains which behavioural dimensions are used in which exercise and gives an account of the different steps of the assessment process. It ends with a description of the main evaluation results and with an indication of possible trends.
Author
Armed Forces (Foreign); Personnel Selection; Personality; Procedures; Human Performance; Human Relations; Switzerland; Qualifications

20000098513 Defence Centre for Leadership, Psychological Div., Copenhagen, Denmark
OFFICER SELECTION IN THE DANISH ARMED FORCES
Meincke, S., Defence Centre for Leadership, Denmark; Officer Selection; August 2000, pp. 3-1 - 3-4; In English; See also 20000098510; Copyright Waived; Avail: CASI; A01, Hardcopy

This paper reviews the psychological part of the present selection process which include intelligence, ability and knowledge tests, a group exercise and interviews by psychologists. The result of the psychological assessment is presented for the selection board. Together with results from tests of physical proficiency and the ratings from the candidates' military service, the selection board will use the psychological report as the basis for the final decision. The results of two studies of the system utility are presented: An investigation of the predictive validity showed that it is possible to forecast the examination result of the officer training with a rather high precision. The investigation showed that it was possible to calculate a prognosis for the examination result from the Officer Academy, where the multiple correlation coefficient with the actual examination result is 0.57 for those, who complete the officers training. Another follow-up study showed that the promotion percent of the officers was rising with increasing psychological assessment.
Author
Personnel Selection; Armed Forces (Foreign); Denmark; Physiological Tests; Intelligence Tests; Abilities

20000098514 Ministry of Defence, Military Psychology Service, Vienna, Austria
THE PSYCHOLOGICAL SELECTION OF OFFICER CANDIDATES IN AUSTRIA
Frise, E., Ministry of Defence, Austria; Officer Selection; August 2000, pp. 4-1 - 4-3; In English; See also 20000098510; Copyright Waived; Avail: CASI; A01, Hardcopy

Austria's psychological officers' selection is an integral part of the selection procedure for officers' training, which lasts for more than a year. During this psychological selection, which takes 22 hours, due to the use of selected stressors and a sleepless night not only intelligence and personality traits can be tested but also (by applying the concept of 'Ergo-Psychometry') individual stress resistance.
Author
Austria; Armed Forces (Foreign); Personnel Selection; Psychological Tests; Personality; Intelligence; Abilities; Qualifications

20000098515 Middle East Technical Univ., Dept. of Psychology, Ankara, Turkey
DEVELOPMENT OF A PERSONALITY TEST BATTERY TO BE USED IN OFFICER SELECTION IN THE TURKISH ARMED FORCES
Sumer, H. Canan, Middle East Technical Univ., Turkey; Sumer, Nebi, Middle East Technical Univ., Turkey; Sahin, Nesrin, Middle East Technical Univ., Turkey; Sahin, Nail, Middle East Technical Univ., Turkey; Demirutku, Kursad, Middle East Technical Univ., Turkey; Eroglu, Burcu, Middle East Technical Univ., Turkey; Officer Selection; August 2000, pp. 5-1 - 5-12; In English; See also 20000098510; Copyright Waived; Avail: CASI; A03, Hardcopy

This study is an earlier step in the development of a personality test battery to be used in the selection of officers recruited from outside sources in the Turkish Armed Forces. Prior to this study, five personality dimensions were identified as being relevant for the job military officer. Items tapping into these dimensions, or more specifically tapping into the attributes loading under the identified dimensions were developed. The test battery was piloted on a group of officers (N = 519). Revisions in the items were made based on internal consistency estimates. Exploratory factor analyses following these revisions led to further refinements in the battery, and consequently to identification of 18 subdimensions under the five factors that were considerably consistent. Furthermore, a preliminary test of the five-dimension model of personality was conducted using a confirmatory factor analysis. Limitations of the research as well as the steps to be followed are described.
Author
Armed Forces (Foreign); Personality Tests; Personnel Selection; Turkey; Abilities

20000098517 Military Academy, Dept. of Behavioral Sciences and Leadership, West Point, NY USA
PERSONALITY HARDINESS AS A PREDICTOR OF OFFICER CADET LEADERSHIP PERFORMANCE
Bartone, P. T., Military Academy, USA; Officer Selection; August 2000, pp. 7-1 - 7-5; In English; See also 20000098510; Copyright Waived; Avail: CASI; A01, Hardcopy

Future military officers must be highly resilient, resourceful, and quick to adjust in rapidly changing situations. In view of this, the time may be now to reconsider the role of normal personality traits that might influence leader performance. A promising personality dimension in this regard is known as 'hardiness'. High hardy persons have a strong sense of life and work commitment, a greater belief of control, and more openness to change and challenges in life. The present study examined one class of USA Military Academy cadets over time, testing the power of hardiness and several additional cognitive and personality variables to predict military leadership performance over a four-year period. In regression models predicting Military Development (MD) grades for each of four college years. as well as cumulative MD grades over four years, hardiness proved a strong and consistent predictor of military development grades for these officer cadets. It appears that hardiness -- this pervasive and steady sense of commitment, control, and challenge -- facilitates adaptation and performance in the highly stressful world of West Point Army officer cadets. Evidence from this study suggests that personality hardiness is advantageous for young and future U.S. Army officers. These findings have implications for officer selection and training.
Author
Armed Forces (United States); Personality Tests; Leadership; Performance Prediction; Abilities; Qualifications

20000098518 Middle East Technical Univ., Dept. of Psychology, Ankara, Turkey
A PERSON-ORIENTED JOB ANALYSIS FOR IDENTIFYING SKILLS AND PERSONALITY ATTRIBUTES TO BE ASSESSED IN OFFICER SELECTION
Sumer, H. Canan, Middle East Technical Univ., Turkey; Sumer, Nebi, Middle East Technical Univ., Turkey; Demirutku, Kursad, Middle East Technical Univ., Turkey; Officer Selection; August 2000, pp. 8-1 - 8-11; In English; See also 20000098510; Copyright Waived; Avail: CASI; A03, Hardcopy

The purpose of the present research was to identify personality constructs to be assessed in the selection of officers in the Turkish Armed Forces using a personality-oriented job analysis approach. Personality-oriented job analytic interviews were conducted both with currently employed and former officers (N = 78). Content-analysis of the interviews led to the identification of a list of attributes presumed to be relevant. The attributes were then rated by a group of officers (N = 447) for relevance and importance. Principal component analysis of the weighted relevance ratings resulted in five personality dimensions as being relevant for the job of an officer: Conscientiousness/Self-Discipline, Military Factor, Self-Confidence, Agreeableness-Extraversion, and Leadership.
Author
Armed Forces (Foreign); Turkey; Personnel Selection; Personality; Abilities; Qualifications; Occupation

20000098519 Army Research Inst., Alexandria, VA USA
OFFICER SELECTION IN THE 21ST CENTURY
Rumsey, Michael G., Army Research Inst., USA; Ford, Laura A., Human Resources Research Organization, USA; Campbell, Roy C., Human Resources Research Organization, USA; Campbell, John P., Human Resources Research Organization, USA; Knapp, Deirdre J.,

Human Resources Research Organization, USA; Walker, Clinton B., Human Resources Research Organization, USA; Officer Selection; August 2000, pp. 9-1 - 9-10; In English; See also 20000098510; Copyright Waived; Avail: CASI; A02, Hardcopy

A key requirement in designing selection systems is determining the attributes of people that underlie their successful performance on the job of interest. The present paper considers junior officer attributes which may be needed for successful performance in the 21st century. This paper examines the application of a methodology and findings from a project examining future attributes needed for noncommissioned officers. It examines projected future changes in the world and the Army environment and considers how these may affect future officer job demands. It then draws inferences about the implications of these changes for the following attributes: general cognitive ability, integrity, achievement motivation, judgment and decision making, social competence, adaptability, communication ability, emotional stability, and physical fitness. While the available information is judged to support the importance of these attributes for the period 2000-2025, the limitations of such information are emphasized. A more thorough analysis using the approach followed in the noncommissioned officer project (NCO21) is recommended.
Author
Personnel Selection; Armed Forces; Human Performance; Occupation; Abilities; Qualifications; Personality

20000098520 Royal Netherlands Army, Behavioral Sciences Div., The Hague, Netherlands
CHANGING JOB REQUIREMENTS IN RELATION TO REQUIRED ABILITIES OR PERSONALITY TRAITS DURING A MILITARY CAREER
Terpstra, J., Royal Netherlands Army, Netherlands; Officer Selection; August 2000, pp. 10-1 - 10-4; In English; See also 20000098510; Copyright Waived; Avail: CASI; A01, Hardcopy

I started my military training at the Royal Military Academy in 1966. I have held several officer positions over the years (including those of company commander of an armored infantry battalion). Over all these years I have needed knowledge, experience and skills to perform these jobs properly. In recent years I have been responsible for the psychological selection policy in the Royal Netherlands Army. In that position I was able to assist in the reassessment of the requirements. This was required because conscription in the Netherlands was suspended a few years ago and in addition the focus has shifted from large-scale, high intensity conflicts to smaller operations in which personnel are required to perform new tasks and different conduct is expected from officers. My paper reviews a Dutch exploratory survey by Wassenberg, which entailed interviews with some twenty former military personnel who have held positions as senior managers. The requirements set of senior management were catalogued on the basis of the study. I shall then proceed to deal with the differences in positions held by officers at the middle and lowest level. The requirements for officers at the various levels can be formulated on the basis of this comparison and the resultant differences. In view of the limited time available today, we can discuss them only summarily. My paper will round off with some concluding remarks.
Author
Netherlands; Armed Forces (Foreign); Occupation; Personality; Abilities; Qualifications

20000098521 Ministry of Defence, Manpower Div., Singapore
RESEARCH AND THEORY ON THE MOTIVATION TO LEAD: IMPLICATIONS FOR OFFICER SELECTION
Chan, Kim-Yin, Ministry of Defence, Singapore; Ong, Kian Chye, Ministry of Defence, Singapore; Chah, Caroline, Ministry of Defence, Singapore; Officer Selection; August 2000, pp. 11-1 - 11-6; In English; See also 20000098510; Copyright Waived; Avail: CASI; A02, Hardcopy

An original theoretical framework for understanding the relationship between individual differences and leadership behavior is described in which a new construct called the Motivation to Lead (MTL) is proposed. A study to develop measures and models for understanding this new construct is then reported. The findings are discussed in terms of their implications for officer selection in the military.
Author
Armed Forces; Personnel Selection; Leadership; Motivation; Qualifications

20000098522 German Armed Forces, Offizierbewerberpruefzentrale Personalamt der Bundeswehr, Cologne, Germany
OFFICER SELECTION IN THE FEDERAL ARMED FORCES OF GERMANY
Birke, Wener, German Armed Forces, Germany; Officer Selection; August 2000, pp. 15-1 - 15-4; In English; See also 20000098510; Copyright Waived; Avail: CASI; A01, Hardcopy

After the end of World War II, Germany did not have any armed forces of its own for a period of ten years. Military officer selection, for the most part, still takes place according to principles that were introduced 1955, which had the objective of preventing as much as possible, any misuse of the armed forces. Only the careers of specialist officers, which were introduced much later, are governed by other rules. The first applicants for commissioned service to be tested for aptitude during the establishment of the Federal Armed Forces (FAF) were former officers of the Wehrmacht, whose ability to lead military units was usually beyond any doubt because they had already sufficiently proven their ability during the war. Aptitude tests did not, therefore, initially focus on abilities the candidates needed in order to meet certain performance requirements, but on personality traits, attitudes and motives that had been declared selection criteria for political and moral reasons. By filling in questionnaires and talking to examiners in interviews, applicants had to prove that they were prepared, without any reservations, to uphold the values of the new democratic Constitution and to treat their subordinates as 'citizens in uniform'. The guidelines for officer selection applicable at that time, incidentally, were reminiscent of the classical educational ideal of 'mens sana in corpore sano'. It seemed that there was no demand for much more than a sound mind in a healthy body because elites of all kinds had fallen into disrepute due to the Nazi ideology. After the first teams of instructors had been accepted for service, more and more young men without prior military service applied; they had to be tested not only for a democratic attitude, but also for the basic ability to learn and discharge leadership tasks. The aptitude test methods were supplemented accordingly, and repeatedly adapted to the changing requirements during the following years. Nevertheless, the following principles have largely remained unchanged.
Author
Germany; Armed Forces (Foreign); Psychological Tests; Qualifications; Personnel Selection

20000098523 Belgian Armed Forces, Centre for Recruitment and Selection, Brussels, Belgium
THE OFFICER SELECTION IN THE BELGIAN ARMED FORCES
Devriendt, Y. A., Belgian Armed Forces, Belgium; Officer Selection; August 2000, pp. 16-1 - 16-4; In English; See also 20000098510; Copyright Waived; Avail: CASI; A01, Hardcopy

In this paper we will discuss the Belgian Armed Forces Officer Selection System (BAF). First of all we will put the Belgian Armed Forces Selection System in perspective by giving some basic information concerning the levels of selection and the numbers of candidates tested. We will give a brief description of the basic selection procedure and of the different possibilities to become an officer. Furthermore the general purpose of the selection system is discussed. Then we will go trough the officer selection profile that the Armed Forces are looking for. Briefly there is an overview of the non-psychological techniques and we will look in more detail to the psychological selection procedures. At the end, some closing observations are given.
Author
Armed Forces (Foreign); Belgium; Personnel Selection; Psychological Tests; Qualifications

20000098524 Naval Aerospace Medical Research Lab., Pensacola, FL USA
SELECTION OF OFFICERS FOR US NAVAL AVIATION TRAINING
Williams, Henry P., Naval Aerospace Medical Research Lab., USA; Albert, Amanda O., Naval Aerospace Medical Research Lab., USA; Blower, David J., Naval Aerospace Medical Research Lab., USA; Officer Selection; August 2000, pp. 18-1 - 18-7; In English; See also 20000098510; Copyright Waived; Avail: CASI; A02, Hardcopy

This paper reviews the process of selecting officers for U.S. naval aviation training and describes one of the principal selection tools, the Aviation Selection Test Battery (ASTB). The 1992 version of the ASTB is a paper-and-pencil test administered to all applicants for naval aviation training. ASTB scores and ground school and flight

training performance data were available for 2852 student naval aviators and student naval flight officers, and these data were used to re-assess the validity of the ASTB in predicting student performance. The results indicated that the ASTB remains a valid predictor of ground school and flight training grades, and to a lesser extent, attrition from training. For a small subset of the sample used in these analyses, data from a computer-based performance test (CBPT) were also available. The CBPT required subjects to engage in multi-axis tracking tasks concurrently with other cognitive tasks, such as dichotic listening and working memory tasks. Scores from the ASTB, the CBPT, and grades from ground school were entered into a linear regression upon primary flight training grades. The results showed that the combination of ground school and CBPT scores can be used as a good predictor of performance (R(sup 2) = .33, p <.0001). Although these results will require cross validation, the CBPT shows promise as a new selection tool. The importance of these results is discussed in the context of a recently developed computer-based version of the ASTB.
Author
Aircraft Pilots; Flight Training; Pilot Selection; Military Aviation; Performance Prediction; Qualifications

20000098525 National Defence Headquarters, Director Human Resources Research and Evaluation, Ottawa, Ontario Canada
CAPSS: THE CANADIAN AUTOMATED PILOT SELECTION SYSTEM
Woycheshin, D. E., National Defence Headquarters, Canada; Officer Selection; August 2000, pp. 19-1 - 19-5; In English; See also 20000098510; Copyright Waived; Avail: CASI; A01, Hardcopy

The Canadian Automated Pilot Selection System (CAPSS) is a computerized simulator of a single engine light aircraft used in the selection of pilots for the Canadian Forces. This paper describes the characteristics of the CAPSS simulator and the types of data it collects. The development of the CAPSS equation that predicts the probability of success in flying training is discussed and the results of the initial validation and cross-validation are presented. Demographic characteristics of applicants assessed by CAPSS since its introduction in February, 1997, are presented. Finally, some of the strengths and weaknesses of CAPSS are discussed.
Author
Computerized Simulation; Pilot Selection; Flight Simulators; Qualifications; Canada; Armed Forces (Foreign); Military Aviation

20000098526 Metrica, Inc., Senior Research Scientists, San Antonio, TX USA
DIFFICULTIES IN ACCESSING A REPRESENTATIVE PILOT FORCE: THE DEMOGRAPHIC CHALLENGE AND VIEWS OF MINORITY PILOT FOCUS GROUPS
Barucky, Jerry M., Metrica, Inc., USA; Stone, Brice M., Metrica, Inc., USA; Officer Selection; August 2000, pp. 20-1 - 20-9; In English; See also 20000098510; Copyright Waived; Avail: CASI; A02, Hardcopy

The USA Air Force has expressed concern about under representation of minority officers in its pilot force. Historically, there have been relatively smaller percentages of African-American and Hispanic officers among Air Force pilots than might be expected from other demographic and educational data. As part of a more general study of demographic trends and their effects on the Air Force personnel system, researchers were tasked to gather information pertaining to minority community attitudes about the military and flying careers. The researchers gathered this information from focus group interview sessions among African-American and Hispanic pilots and pilot trainees and from Air Force Academy and Air Force Reserve Officer Training Corps (AFROTC) minority recruiters. The responses highlight reasons for the lack of interest in flying careers among the most competitive minority students. They also offer suggestions for enhancing the selection/recruitment and training processes to attract a greater percentage of the highly qualified minority students and allow them to compete successfully for pilot positions. This paper presents a brief summary of that report (Barucky, 1998).
Author
Armed Forces (United States); Aircraft Pilots; Minorities; Occupation; Pilot Selection; Motivation

20000098527 Turkish Air Force Academy, Human Resources Center, Istanbul, Turkey
OFFICER AND PILOT SELECTION SYSTEM IN TURKISH AIR FORCE
Bekmezci, Ilker, Turkish Air Force Academy, Turkey; Officer Selection; August 2000, pp. 21-1 - 21-8; In English; See also 20000098510; Copyright Waived; Avail: CASI; A02, Hardcopy

In contrast to expectations, with the pace of developing technology, the human factor has become one of the most important elements in the organizations. Especially, in complex systems, like aviation, the human factor is even more critical. The fact that the cause of 80% of flight accidents in the last 40 years is related to human factor underlines the importance of human factor in this area. According to the current laws, the aim of the Turkish Air Force Academy (TAFA) is to produce pilot candidate officers. In other words, all officers are aimed to be trained as pilots. Therefore, the officer selection system and pilot selection system is organized in an integrated way. In order to accomplish this critical mission, Turkish Air Force that has always been conscious of the importance of human factor has already developed a complex and multi-staged selection system for Turkish Air Force Academy. The first step of the system is national university entrance test. The election system also includes medical check-up, physical fitness test, various ability and personality tests, three different interviews. The candidates, who succeed to pass these stages, fly a propeller-training plane for 11 hours. At the end of this training, the successful candidates take basic military training. The candidates achieve to pass all the stages successfully can be a student in the Academy. In this paper, the details of this integrated selection system are introduced and the recent improvements in the system are explained.
Author
Armed Forces (Foreign); Turkey; Pilot Selection; Qualifications; Pilot Training

20000098528 Ukrainian Armed Forces, Research Inst. of Military Medicine, Irpen, Ukraine
THEORETICAL AND ORGANIZATIONAL ASPECTS OF PROFESSIONAL AND PSYCHOPHYSIOLOGICAL SELECTION OF MILITARY SERVICEMEN IN ARMED FORCES OF UKRAINE
Korolev, V. V., Ukrainian Armed Forces, Ukraine; Varus, V. I., Ukrainian Armed Forces, Ukraine; Zhakhovsky, V. N., Ukrainian Armed Forces, Ukraine; Volyansky, A. N., Ukrainian Armed Forces, Ukraine; Officer Selection; August 2000, pp. 22-1 - 22-4; In English; See also 20000098510; Copyright Waived; Avail: CASI; A01, Hardcopy

The development of the Armed Forces of Ukraine and transition to the professional basis of recruitment of military units pose the specific demands to psychophysiological and moral-psychological condition of the officers. The process of reforming the Armed Forces of Ukraine, one element of which is the reduction of the number of servicemen while still maintaining adequate defensive capability of the country should be implemented by using the science-based methodology of studying and practical application of the 'human factor' concept, its role and place in estimation of fighting capability of military units. Obviously, the further perfection of battle systems and facilities should be connected to psychophysiological provision of training and battle activity of the troops.
Author
Armed Forces (Foreign); Psychophysiology; Ukraine; Pilot Selection; Qualifications

20000098529 Aeronautica Militare Italiana, Centro di Selezione, Rome, Italy
SIGNIFICANCE OF METACOGNITIVE VARIABLES ON OFFICER SELECTION
Serusi, Carlo, Aeronautica Militare Italiana, Italy; Autore, Alberto Maria, Arma dei Carabinieri, Italy; Officer Selection; August 2000, pp. 23-1 - 23-4; In English; See also 20000098510; Copyright Waived; Avail: CASI; A01, Hardcopy

The events which have occurred on the international geopolitical scene in the last years have determined the need of a change of the principles which the national defense policy were traditionally inspired to. The end of the so-called 'cold war' in particular, making an aggression from the East very improbable and consequently breaking up the bonds imposed by the culture of the opposite blocks, enabled the emerging of multiple crisis on a regional and local level in opposition to the regained global safety, In this scene, the new

defense concept, which has progressively asserted itself, has abandoned the traditional static nature in favor of a more dynamic concept, mainly projected out of the national borders and engaged in safe-guarding the stability of international relationships and in the settlement of the ethnical and religious disputes.
Author
Armed Forces; Personnel Selection; Qualifications; Cognitive Psychology; Abilities

20000098530 Royal Air Force Coll., Officer and Aircrew Selection Centre, Cranwell, UK
OFFICER QUALITIES
Thompson, Robert W., Royal Air Force Coll., UK; Officer Selection; August 2000, pp. 24-1 - 24-6; In English; See also 20000098510; Copyright Waived; Avail: CASI; A02, Hardcopy

The qualities of an officer have been analyzed and defined countless times, over many centuries. Probably, there is no single accurate description which can encompass completely these myriad views and opinions. This presentation will be a personal view on officer qualities by a UK officer with 2 five-year experiences in selecting officer cadets and then training then during their initial officer training. Discussion will revolve around the qualities of an officer and will try to differentiate the true, effective leader from those who sometimes wear the trappings of rank without, perhaps. having many real leadership qualities. There is often confusion between Management and Leadership and so the differences between the 2 styles will be briefly analyzed. Listed also for consideration will be the leadership qualities which are regarded as important by 4 separate NATO military academies. Clearly, these lists are for the ideal, generic officer and it is interesting to note the difference in emphasis between the various lists of the different training establishments. The paper will finally move on to officer Selection and highlight some of the qualities, raw or potential, which can be identified and assessed during an officer selection process.
Author
Armed Forces (Foreign); United Kingdom; North Atlantic Treaty Organization (NATO); Qualifications; Personnel Selection

20000098531 Royal Air Force, Directorate of Recruiting and Selection, Cranwell, UK
EVOLUTION OF APTITUDE TESTING IN THE RAF
Bailey, M., Royal Air Force, UK; Officer Selection; August 2000, pp. 25-1 - 25-7; In English; See also 20000098510; Copyright Waived; Avail: CASI; A02, Hardcopy

This paper outlines the history of the RAF aptitude test system and the changes made to aptitude test development programmes and testing policies which have been driven by technological and psychological advances and the requirements to assess for different specialisations and be cost effective. Consideration is also given to the next generation of aptitude tests.
Author
Aptitude; Pilot Selection; Armed Forces (Foreign); Qualifications; United Kingdom; Pilot Training

20000098532 National Defence Coll., Karlstad, Sweden
SWEDISH OFFICER SELECTION
Carlstedt, Leif, National Defence Coll., Sweden; Widen, Henry, National Defence Coll., Sweden; Officer Selection; August 2000, pp. 26-1 - 26-6; In English; See also 20000098510; Copyright Waived; Avail: CASI; A02, Hardcopy

The use of psychological methods as an aid to officer selection in the Swedish armed forces dates back to the early 1940's. The psychological examinations at that time were heavily influenced by German methods developed in the 1930's with an emphasis on personality variables. In 1996, a new system was introduced, which is based on the theories of Jaques and Stamp and on the philosophy that the first stage of selection must be directed at deselecting applicants not at all suited for the officer profession, rather than trying to find those best suited. The new system has three main components: A cognitive test battery, a personality inventory and an interview. The test battery, comprising three inductive, four spatial and five verbal tests, was constructed with the aid of confirmatory factor analysis. It is evaluated in independent (orthogonal) factor scores over the three latent intelligence factors G (general), Gv (visualization) and Gc (crystallized), as well as in co-varying (oblique) factor scores over the factors inductive, spatial, and verbal intelligence. The personality inventory was also constructed using confirmatory factor analysis. It has 155 statements that yield five independent factors labeled Subjective Leadership Potential, Inflexibility, Adventurousness, Opportunism and Unreliability. The interview is semi-structured and lasts for about 90 minutes. It results in ratings of the six variables Social ability, Motivation for the profession, Emotional stability, Intellectual ability, Energy and Maturity. Construction of criterion instruments is under way, but so far it has not been possible to assess the predictive validity of the instruments due to the fact that criteria have as yet not been available.
Author
Armed Forces (Foreign); Sweden; Qualifications; Personality Tests; Intelligence Tests; Psychological Tests

20000098533 Abertay Univ., Div. of Psychology, Dundee, UK
METACOGNITIVE, SOCIAL AND INTERPERSONAL SKILLS AND APTITUDES IN OFFICER PERFORMANCE WITH DISTRIBUTED TEAMS
Cook, Malcolm James, Abertay Univ., UK; Klumper, Willem, Netherlands Defence Coll., Netherlands; Officer Selection; August 2000, pp. 27-1 - 27-14; In English; See also 20000098510; Copyright Waived; Avail: CASI; A03, Hardcopy

Military services, Police, Fire Brigade, Medical Emergency Teams and various other task cohesive groups require supervisory management to ensure that goals are met in a manner which is flexible, reduces risk, is resource economical, and promotes team development. Many of the military and emergency teams require leadership via mediated communication because different elements of the team perform functions in different locations. There is adequate evidence from research on the use of different types of media, with different rules of interaction, with different groups and tasks that performance varies significantly in process and outcome terms between face-to-face and mediated communication variants (Anderson, Newlands, Mullin and Fleming, 1996; Archer, 1990; Christensen and Fjermestad, 1997; El-Shinnawy, and Vinze, 1997; Hollingshead, 1996a, 1996b; Valacich and Schwenk, 1995; Lim and Benbasat , 1997; Reid, Ball, Morley and Evans, 1997), with performance generally poorer in mediated (non face-to-face) situations. Analysis of leadership roles in general clearly indicate the significance of insightful management of relationships among team members and their relation to the outside world (Katzenbach and Smith, 1994). The priorities identified by this very early work is identified in short pocket guides (Fleming, 1996; Hardingham, 1995; Birch, 1999; Heller, 1999) and in more academic reviews (Larson and Lafasto, 1989; Hartley, 1997; Belbin, 1999). The significant issues in leadership are: 1) The management of goal orientation. 2) Building confidence. 3) Managing the resource availability in the team. 4) Articulating performance with other teams. This emphasis on relationships and intelligent asset management (human and material) supports the general tenets of this paper which emphasises the need for metacognitive, social and interpersonal skills in effective leadership. Early research such as that of Stogdill (1974) indicated that leaders tended to be more intelligent, sociable, and achievement oriented (internally motivated by their own standards). This paper recognises the tendency for managers and leaders to be merged into one individual as the downward pressure on military and civil institutions creates flatter management groupings from fewer numbers of individuals. In addition it is acknowledged that both the pace of modern warfare and the need for resistant or robust command and control, results in distributed leadership and management on the battlefield, in the air and at sea.
Author
Cognition; Social Factors; Human Relations; Personnel Selection; Aptitude; Emergencies; Qualifications; Command And Control; Rescue Operations

20000098534 Belgian Air Force, Center for Recruitment and Selection, Brussels, Belgium
DATA INTEGRATION AND CLASSIFICATION FOR AN OFFICER SELECTION SYSTEM
Lescreve, Francois J., Belgian Air Force, Belgium; Officer Selection; August 2000, pp. 28-1 - 28-7; In English; See also 20000098510; Copyright Waived; Avail: CASI; A02, Hardcopy

This paper focuses on the integration of different selection data in order to select and assign officer applicants. First the problem is defined. Three topics are discussed in more detail: the heterogeneousness of the selection data on hand and the problems this can

cause, the integration of selection data in order to estimate the suitability of an individual for a specific officer training and the problem of the allocation of candidates to different vacancies. Next, possible approaches are discussed and finally, the paper comes to some conclusions. These advocate the use of modern multi-criteria and multidimensional classification methods to capitalize on the applicant population to optimize the officer corps quality.
Author
Personnel Selection; Armed Forces; Qualifications; Education; Data Integration; Classifications; Personality

20000098535 French Air Force, Bureau Evaluation, Paris, France
RECRUITING AND SELECTION IN THE FRENCH ARMY
Lagache, Stephane, French Air Force, France; Officer Selection; August 2000, pp. 29-1 - 29-7; In English; See also 20000098510; Copyright Waived; Avail: CASI; A02, Hardcopy

The international context evolution has involved in a reorganization of our army structures, a tightening of the forces conjointly the end (adjournment) of the conscription. In this period of intense transformation, selection, recruiting and training of officers and non-commissioned officers (NCO) must take into consideration, What we call 'refoundation' in the Army infers in the field of human resources an ever-increased claim of performance which is relied on a dynamic management of carriers according to abilities and with the age and recruiting origin. So it matters today to adopt our selection orientation and recruiting system to respond on these new requirements. Within this framework, the Army first at all aims two main goals defining a new balance between quality demanding and the research of the maintenance of officer's Corp cohesiveness.
Author
Armed Forces (Foreign); France; Personnel Selection; Qualifications; Abilities

20000098536 National Defence Headquarters, Director Human Resources Research and Evaluation, Ottawa, Ontario Canada
THE CANADIAN FORCES OFFICER SELECTION SYSTEM
Woycheshin, D. E., National Defence Headquarters, Canada; Officer Selection; August 2000, pp. 30-1 - 30-4; In English; See also 20000098510; Copyright Waived; Avail: CASI; A01, Hardcopy

This paper provides a brief overview of the officer selection process for the Canadian Forces. The current size of the Canadian Forces and officer applicant and enrollee statistics for the main enrollment plans are included. The applicant processing sequence is described in general. Applicant attributes assessed in the selection interview and areas used to assign a specific occupation are discussed. Specific selection instruments, including aptitude testing, medical evaluation, the selection interview and fitness testing are described, and the use of these sources of information in the decision process is reviewed. Finally, the Naval Officer Assessment Board and the Air Crew selection procedures are described.
Author
Personnel Selection; Armed Forces (Foreign); Canada; Qualifications; Abilities

20000098537 Dutch Armed Forces, Defense Recruitment and Selection, Amsterdam, Netherlands
CAN PSYCHOLOGICAL SELECTION BE THE SAME FOR ALL DUTCH OFFICERS?
Visser, Wim H. M., Dutch Armed Forces, Netherlands; Officer Selection; August 2000, pp. 31-1 - 31-3; In English; See also 20000098510; Copyright Waived; Avail: CASI; A01, Hardcopy

Since a couple of years there is in the Netherlands one national Defense Selection center. With the exception of pilots all Dutch officers are selected there. In this Selection Center there is a tendency to equalize as far as possible the procedures for the different officer corps, and to differentiate only when there are different requirements in practice. In this reading on the officer selection in the Netherlands the different procedures for four Armed Forces is discussed and the tendency to make them more uniform. First I will give a survey of the officer selection and some background information about the Dutch military forces. Then I will speak about the different phases of the selection process. At first the administrative pre-selection, where the first screening takes place, in which there is decided if the applicant is admitted to the official selection. Next the psychological examination, existing of capability tests, personality questionnaires, and the interview; the medical examination with connecting physical tests; assessment tests for the Corps Marines and for pilots, and finally the Selection Admission Boards. In each phase of the selection procedure I will indicate the differences between the Forces, and explain on which grounds these differences are made.
Author
Armed Forces (Foreign); Netherlands; Personnel Selection; Psychological Tests; Qualifications; Military Psychology

20000098538 Polish Air Force Inst. of Aviation Medicine, Dept. of Psychology, Warsaw, Poland
THE CONCEPTUAL SYSTEM OF OFFICER APPLICANTS TO MILITARY HIGH SCHOOLS FROM THE AIR FORCE, THE NAVY AND THE ARMY IN POLAND
Truszczynski, O. E., Polish Air Force Inst. of Aviation Medicine, Poland; Terelak, J. F., Polish Air Force Inst. of Aviation Medicine, Poland; Officer Selection; August 2000, pp. 32-1 - 32-4; In English; See also 20000098510; Copyright Waived; Avail: CASI; A01, Hardcopy

The paper contains the basic information concerning the system of officer applicants to Military High Schools in Poland. It is presented methods of psychological assessment of the applicants and the role of psychologists in the whole recruitment procedures.
Author
Armed Forces (Foreign); Poland; Personnel Selection; Qualifications; Psychological Tests

20000098539 Saville and Holdsworth Ltd., UK R and D Director, Thames Ditton, UK
TECHNOLOGIES FOR INTEGRATED ASSESSMENT AND SELECTION SYSTEMS
Burke, Eugene, Saville and Holdsworth Ltd., UK; Officer Selection; August 2000, pp. 33-1 - 33-5; In English; See also 20000098510; Copyright Waived; Avail: CASI; A01, Hardcopy

This paper looks forward from the last Nato review of computer-based assessment (CBA) of military personnel (Burke and Van Raay, 1993; see also Burke, 1993, and Burke et al., 1995). At the time of that report, research and development among Nato nations could be summarized according to three areas of work: (1) Desktop systems delivering traditional tests and questionnaires as well as more dynamic tasks developed from paradigms from cognitive psychology, using LANs and WANs, and from which the principle gains were the increased reliability and reduced costs from automation of the assessment process. Systems characterizing this approach included those developed by the Royal Air Force (RAF) in the UK for officer and aircrew selection (Burke, 1992, and Burke et al., 1994), Project A in the US, Taskomat in the Netherlands and the ESPACE system in France. (2) Simulation-based assessment (SBA) systems for delivery of sophisticated work sample measures usually administered after prior screening using paper-and-pencil or desktop tests and questionnaires, and developed for selection to high risk/high cost roles such as aircraft pilot. Systems characterising this approach included the CAPSS system in Canada and the GUTS in Belgium, as well as a range of systems developed in Germany. The primary focus of these systems was increased validity and reduced training costs against which the substantial costs of SBA development and administration could be recovered. (3) Adaptive testing systems that sought to exploit capabilities unique to CBA in delivering tailored testing (i.e. measurement geared to an individual's level of ability). The US CAT-ASVAB programme stands as the most substantial work in this area to date. As well as adaptive testing, the late 1980s and early 1990s also saw the advent of item generation techniques in which item engines contained in the test software produce the item or task on-the-fly during a test administration. The UK British Army Recruit Battery (BARB) system was the first item generative system to go live in military assessment, though the same methodology was also used to produce fixed parallel forms of paper-and-pencil tests for the Royal Navy (the ABC test battery).
Author
Computer Techniques; Personnel Selection; Computer Programs; Aircraft Pilots; Qualifications; Psychological Tests

20000098540 Royal Air Force Coll., Officer and Aircrew Selection Centre, Cranwell, UK
THE STRUCTURED INTERVIEW
Thompson, Robert W., Royal Air Force Coll., UK; Officer Selection;

August 2000, pp. 12-1 - 12-10; In English; See also 20000098510; Copyright Waived; Avail: CASI; A02, Hardcopy

'Employee selection is usually a lottery, and interviews are not the best forum for checking the right person'. This is a recent claim by a UK firm of recruitment consultants which advocates its own assessment centre as the way ahead for graduate recruitment. Research by another recruitment group, Robert Half International, indicates that it takes only a matter of minutes for the interviewer to decide whether the body on the other side of the desk is the right person for the job. This research indicated that more than 20% of managers who were interviewed claimed that they could make up their minds about a candidate within one to five minutes. A further 45% believed that they were able to sum up a person's suitability in under 15 minutes. If these figures are correct, then clearly the way the candidate walks, dresses and how the body language shapes up for the first handshake can all have a major effect on deciding which way a career and life-changing interview may go. Headhunters and executive search specialists all report that, however well-intentioned, objective and scientific the interview system, there are certain prejudices which can never be eradicated. For instance, for most there is a natural preference for working with good-looking people. Significantly. it is no coincidence that there are disproportionately few good-looking people doing menial jobs. It is current fashion therefore to discredit the interview as a means of selection. However, the Royal Air Force uses a structured interview as an initial assessment procedure and also as a useful filter for candidates seen as less able. Following interview, candidates are graded on a scale of 1 (lowest) to 7 (highest). Statistical analysis of successful officer candidates shows a persuasive correlation between interview grades and the quality of success during officer training. The Royal Air Force is of the firm opinion that the structured interview remains a successful yardstick and tool during officer selection. How is this so? (1) First and foremost. the interviewers, who always have a wealth of general military experience, are formally trained interviewers. The interview Board consists of 2 senior officers. (2) Secondly, the interview is specifically structured and tailored to elicit and accurate picture of the candidate, vis-a-vis his/her suitability for officer training. (3) Following the interview, where there is a difference of opinion, the differences are discussed and a compromise agreement is reached. Where there is no compromise (and this is rare) differences are recorded and then independently reviewed. (4) The interview Boards are subjected to regular standardization checks by an independent board of assessors. Experience has shown that the structured interview carried out by 2 formally trained officers, has a high degree of objectivity. The interview lasts for 45 minutes and all of that time is essential, plus later discussion between Board Members, to formulate an overall opinion and assessment. Within the Royal Air Force Officer and Aircrew Selection Centre, the structured interview remains an integral and accurate method of assessment.

Author

Pilot Selection; Armed Forces (Foreign); United Kingdom; Qualifications

20000098541 Royal Military Academy, Dept. of Psychology, Brussels, Belgium

MATCHING SELECTION CRITERIA AND ULTIMATE VOCATIONAL CRITERIA FOR OFFICERS IN THE BELGIAN ARMED FORCES

Mylle, Jacques, Royal Military Academy, Belgium; Officer Selection; August 2000, pp. 13-1 - 13-7; In English; See also 20000098510; Copyright Waived; Avail: CASI; A02, Hardcopy

Before 1990, the military context of employment was relatively uniform. Dramatic changes since then - a new vision on leadership, and the multiple vacancies for applicant officers - gave raise to the question if differentiation in selection criteria would not be more appropriate than the overall procedure in use, given the (hypothesized) differentiation in ultimate vocational criteria. This question falls apart into two questions: 1) which are those ultimate criteria? and 2) which of them apply to whom and to what extent? In a first step, an inventory of criteria ought relevant was drawn, resulting in a list of 118 criteria. In a second step, factor analysis was used to regroup these criteria on the basis of common latent factors. Six factors were found; corresponding to the 'Big Five' of personality and one military factor. In a third step, the relative importance of those criteria was assessed and, finally, discriminant analysis was used to distinguish between 'kinds' of officers on the basis of those common factors. These 'kinds' refer to three different aspects: the status, the studies done as applicant officer, and the different Services, Specialties, Arms and Type of units.

Author

Armed Forces (Foreign); Belgium; Personnel Selection; Qualifications; Factor Analysis; Criteria

20000105072 Institut de Medicine Aerospatiale Armee, Bretigny sur Orge, France

SLEEP AND AGE: FROM PHYSIOPATHOLOGY TO THERAPEUTICS

Agarde, Dider I., Institut de Medicine Aerospatiale Armee, France; Catrycke, Marc, Institut de Medicine Aerospatiale Armee, France; Billaud, Philippe, Institut de Medicine Aerospatiale Armee, France; Ramont, Laurent, Institut de Medicine Aerospatiale Armee, France; Guilbaut, Bruno, Institut de Medicine Aerospatiale Armee, France; Operational Issues of Aging Crewmembers; August 2000, pp. 14B-1 - 14B-6; In English; See also 20000105060; Copyright Waived; Avail: CASI; A02, Hardcopy

Circadian rhythms and especially light/dark cycle have been studied using paraclinical (EEG, MSLT, actimetry) and biochemical (melatonin level) methods and neuropsychological tests which evaluate sleep disorders effects. These investigations allow to point out significant changes in sleep as soon as 35 years old. The purpose of this paper is to sum up current knowledge of age influence on sleep and therapeutic ways of good sleep quality recovery or wakefulness preservation, in military operational condition.

Author

Age Factor; Sleep; Sleep Deprivation; Wakefulness; Armed Forces (Foreign); Personnel

20000105078 Department of the Air Force, Brooks AFB, TX USA

NEUROPSYCHIATRIC AEROMEDICAL REFERRALS: DO TRENDS VARY WITH AGE?

Orme, Daniel, Department of the Air Force, USA; Thompson, Bill, Department of the Air Force, USA; Operational Issues of Aging Crewmembers; August 2000, pp. 21-1 - 21-4; In English; See also 20000105060; Copyright Waived; Avail: CASI; A01, Hardcopy

Four hundred eighty one records of aviators evaluated at the Neuropsychiatry Branch of the USAF Aeromedical Consultation Service were reviewed to assess diagnostic trends among this group. Sixteen psychiatric diagnoses were variously represented in the sample with relatively mild disorders (reactive disorders -- 19.7 percent, other psychosocial problems -- 15.2 percent, and neurotic disorders -- 13.3 percent) accounting for nearly 50 percent (48.2) of the disorders. Younger aviators aviators were significantly less likely ($p<.001$) to be seen for evaluation than older ones. Finally, diagnoses were not evenly distributed across all age groups; some diagnoses were more strongly associated with some age groups than others. Overall, results suggest some differential vulnerability to neuropsychiatric conditions depending upon the age of the aviator and the diagnosis in question.

Author

Neuropsychiatry; Psychotherapy; Mental Health; Aerospace Medicine

20010002092 Research and Technology Organization, The Human Factors and Medicine Panel, Neuilly-sur-Seine, France

COGNITIVE TASK ANALYSIS *[L'ANALYSE DES TACHES COGNITIVES]*

October 2000; 53p; In English; The CD-ROM contains full text in PDF format

Report No.(s): RTO-TR-24; AC/323(HFM)TP/16; ISBN 92-837-1045-2; Copyright Waived; Avail: CASI; C01, CD-ROM; A01, Microfiche; A04, Hardcopy

Cognitive task analysis is defined as the extension of traditional task analysis techniques to yield information about the knowledge, thought processes and goal structures that underlie observable task performance. Cognitive task analyses are conducted for a wide variety of purposes, including the design of computer systems to support human work, the development of training, and the development of tests to certify competence. As part of its Programme of Work, NATO Research Study Group 27 on Cognitive Task Analysis has undertaken the task of reviewing existing cognitive task analysis techniques. The Group concludes that few integrated methods exist, that little attention is being paid to the conditions under which

methods are appropriate, and that often it is unclear how the products of cognitive task analysis should be used. RSG.27 has also organized a workshop with experts in the field of cognitive task analysis. The most important issues that were discussed during the workshop were: (1) the use of CTA in the design of new systems, (2) the question when to use what technique, and (3) the role of CTA in system design. RSG.27 emphasizes: (1) that is important for the CTA community to be able to empirically demonstrate the added value of a CTA; (2) it is critical for the success of CTA to be involved in the design process from the start to finish, and to establish clear links with methods that are used by other disciplines; and (3) recommends that more research effort be directed to the issue of the reliability of CTA techniques.
Author
Cognition; Mental Performance; Human Factors Engineering; Human-Computer Interface; Command And Control; Education; Tasks

20010002523 Technische Hogeschool, Dept. of Information Sciences, Delft, Netherlands
INVESTMENT EVALUATION OF TECHNOLOGY-BASED TRAINING SYSTEMS: TRAINING NEEDS ANALYSIS IN THE ROYAL NORWEGIAN NAVY
Berghout, Egon W., Technische Hogeschool, Netherlands; Svendsen, Christian, Siemens Nederland N.V., Netherlands; Thomassen, Ivar Wessel, HNoMS Tordenskjold, Norway; The Capability of Virtual Reality to Meet Military Requirements; November 2000, pp. 1-1 - 1-8; In English; See also 20010002522; Copyright Waived; Avail: CASI; A02, Hardcopy

This paper describes the results of a research done in the Royal Norwegian Navy into the decision structure of the evaluation process of investing in technology-based training systems. A comprehensive methodology was developed, that evaluates technology-based training systems as information systems. The evaluation method can reveal cost driving training objectives and make sure focus on the strategic value of the information system components is maintained.
Author
Training Evaluation; Training Analysis; Education; Technology Assessment; Information Systems

20010002536 Army Research Inst., Orlando, FL USA
INTERFACE ISSUES IN THE USE OF VIRTUAL ENVIRONMENTS FOR DISMOUNTED SOLDIER TRAINING
Knerr, Bruce W., Army Research Inst., USA; The Capability of Virtual Reality to Meet Military Requirements; November 2000, pp. 14-1 - 14-7; In English; See also 20010002522; Copyright Waived; Avail: CASI; A02, Hardcopy

In 1992 the U.S. Army Research Institute for the Behavioral and Social Sciences (ARI) initiated a program of in-house experimentation to investigate the use of virtual environments (VE) technology to train dismounted soldiers. Since that time, we have conducted thirteen experiments examining human performance in VE, training effectiveness and transfer of skills acquired in VE to the real world, and side-effects and after-effects of exposure to VE. The tasks used have included distance estimation, tracking, object manipulation, visual search, route learning in buildings, building search, and land navigation. This paper summarizes results from these experiments related to visual display characteristics and methods of locomotion. The most common VE display systems, low- to moderate-cost head mounted displays (HMDs), limit performance with low resolution and small fields of view (FOVs). Performance on a variety of distance estimation tasks is significantly worse than performance on similar tasks in the real world. Providing stereoscopic view improves performance, but only at short distances. Increasing the field of view while holding resolution constant improves performance. Linking the viewpoint to head movements improves distance estimates and, under some conditions, spatial knowledge acquisition. For some tasks, performance using a monitor is better than performance using an HMD, while on other tasks, the reverse is true. A variety of methods have been used to simulate walking in VE: joystick, spaceball, treadmills, and walking in place (with instrumentation to sense steps). Few direct comparisons of these methods have been made. For some tasks, a joystick combined with auditory cueing may provide an effective substitute for high-cost locomotion simulators.
Author
Human-Computer Interface; Virtual Reality; Environment Simulation; Helmet Mounted Displays; Education

20010003248 Institute for Human Factors TNO, Soesterberg, Netherlands
INTERACTION INDIVIDUAL AND TEAM PERFORMANCE IN SHIP COMMAND CENTERS
Essens, Peter J. M. D., Institute for Human Factors TNO, Netherlands; Usability of Information in Battle Management Operations; November 2000, pp. 3-1 - 3-5; In English; See also 20010003245; Copyright Waived; Avail: CASI; A02, Hardcopy

An assessment of a fully operational command center performing under high pressures in information load, time stress, and cognitive complexity has shown that in particular, four factors play a crucial role: (1) individual information processing, (2) team management, (3) communication load, and (4) the distribution of tasks. It is concluded that individual processes and team processes compete with each other. If individuals are getting loaded then first those tasks will be dropped that are demanding and do not lead towards direct feedback. Team tasks suffer most under these conditions.
Author
Human Performance; Information Management; Teams; Information Transfer; Workloads (Psychophysiology)

20010003251 Army Natick Research and Development Command, MA USA
TOWARD A METHODOLOGY FOR EVALUATING THE IMPACT OF SITUATION AWARENESS ON UNIT EFFECTIVENESS OF DISMOUNTED INFANTRYMEN
Blackwell, Cynthia L., Army Natick Research and Development Command, USA; Redden, Elizabeth S., Army Research Lab., USA; Usability of Information in Battle Management Operations; November 2000, pp. 8-1 - 8-6; In English; See also 20010003245; Copyright Waived; Avail: CASI; A02, Hardcopy

The USA (US) Department of Defense initiated a program in 1997 called the Military Operations in Urban Terrain Advanced Concept Technology Demonstration (MOUT ACTD). MOUT ACTD is a joint US Army-Marine Corps. program led by the US Army Soldier and Biological Chemical Command. The MOUT ACTD's charter is to seek technologies that satisfy 32 jointly derived requirements specific to operations in 'built up' or urban areas. MOUT ACTD evaluates these candidate technologies for military utility and transitions the successful candidates to acquisition programs for further development and fielding. One of the determinants of military utility that the MOUT ACTD program uses is situation awareness (SA) - specifically, the influence of SA on individual and force effectiveness as a result of the use of MOUT-related technologies. SA is defined here as the warrior's ability to quickly perceive and then discriminate between facets of the tactical environment, to accurately assess and reassess the where, when, and why of that environment, to then know and understand the nature of the tactical situation and to extrapolate near term courses of action based on this understanding. This paper describes the process by which the MOUT ACTD program developed and implemented a method for determining the impact of SA on individual and force effectiveness.
Author
Military Technology; Technology Utilization; Evaluation; Human Performance; Human Reactions

20010016873 Defence Evaluation Research Agency, Centre for Human Sciences, Farnborough, UK
THE RISK OF HUMAN ERROR: DATA COLLECTION, COLLATION, AND QUANTIFICATION
Chappelow, J. W., Defence Evaluation Research Agency, UK; The Human Factor in System Reliability: Is Human Performance Predictable?; January 2001, pp. 6-1 - 6-8; In English; See also 20010016868; Original contains color illustrations; Copyright Waived; Avail: CASI; A02, Hardcopy

Human performance poses significant problems in system reliability assessment. Are realistic assessments of safety in systems involving humans possible? Can human performance be quantified? What aspects of human performance are predictable? Practical experience in the field of aviation safety suggests some answers to these question
Author
Aircraft Safety; Human Performance; Reliability; Risk; Safety

20010032438 Royal Danish Navy, Danish Armed Forces Health Services, Gentofte, Denmark
THE EFFECTS OF EXHAUSTIVE MILITARY ACTIVITIES IN MAN. THE PERFORMANCE OF SMALL ISOLATED MILITARY UNITS IN EXTREME ENVIRONMENTAL CONDITIONS
Vanggaard, Leif, Royal Danish Navy, Denmark; The Effect of Prolonged Military Activities in Man. Physiological and Biochemical Changes. Possible Means of Rapid Recuperation; March 2001, pp. 9-1 - 9-10; In English; See also 20010032429; Copyright Waived; Avail: CASI; A02, Hardcopy

Denmark has since 1951 operated its dog-sledge patrol SIRIUS along the North-eastern shores of Greenland. On each patrol 2 men and 10 dogs covers between 3000 to 4000 km. In this service they may not have any encounter with other humans for a period of 4-5 months. For this duty pre-deployment screening, selection, and training is of utmost importance. The decisive factor in succeeding in this military task is that each man gain confidence in himself and his colleagues. The role of experience is vast, but as each man is only assigned to this duty for 2 consecutive years it means that the 'memory' knowledge stored within the members of the SIRIUS patrol only amounts to two years. Each individual thus has to master all the details of Arctic life necessary to live and accomplish his tasks. One of the operational principles is to regard the service in the patrol not as one of survival, but one of doing a regular job. The term survival technique is only attributed to those situations, where life is really at stake. The aim of this article is to focus on selection criteria for duty in isolated areas, on factors relevant for such a duty, the importance and content of training, the role and duties of the back-up organization, and finally how this is accomplished in the operations of the Danish dog-sledge patrol in the Northernmost Arctic. Operating small isolated military units especially under extreme climatic conditions present a series of problems. Most nations do have such units dedicated to these tasks. The problems will change from mission to mission, but there are certain general aspects. One way to define these is to look at specific groups and from these try to come to a conclusion and determination of the common problems. Many of these may present themselves as very different, but analysed it may turn out, that the difference between operating in the cold of the high Arctic or the heat of the desert may less than expected. In Denmark the service of the Danish Sledge Patrol SIRES in the isolated parts of Northern Greenland may serve as the model for describing the problems in operating isolated military units.
Author
Backups; Education; Males; Survival; Performance Prediction; Armed Forces

20010055573 Research and Technology Organization, Human Factors and Medicine Panel, Neuilly-sur-Seine, France
OFFICER SELECTION *FINAL REPORT [LA SELECTION DES OFFICIERS]*
Lescreve, F. J., Belgian Air Force, Belgium; May 2001; 154p; In English; CD-ROM contains full text document in PDF format
Report No.(s): RTO-TR-034; AC/323(HFM-023)TP/26; ISBN 92-837-1067-3; Copyright Waived; Avail: CASI; C01, CD-ROM; A08, Hardcopy; A02, Microfiche

From the end of 1997 till mid 2000, members of the Research and Study Group 31 (RSG 31) from Belgium, Canada, Denmark, France, Germany, the Netherlands, the UK, and the USA focused on the topic of Officer Selection. In order to share information and foster a scientific and professional approach to Officer Selection, two major products were delivered. The first was a workshop on Officer Selection held in November 1999 from which the proceedings were published. The final report on Officer Selection is the second achievement of the RSG. After the introduction, an overview is given of the current officer selection practice. A detailed review of the systems used in the countries participating to the research and study group is given and a summary is provided. Then the main results of a survey on officer selection are presented. This survey covers the current practice in nineteen NATO and non-NATO countries. The actual questionnaire is also included. Following the description of the current practice, the search for an ideal system is commented, a conceptual approach is developed, the qualities of an officer are discussed, a personnel selection primer is given and guidelines for test-use are highlighted. The RSG is convinced that a re-examination of any national system in the light of the practice in other countries together with the scientific and professional guidelines developed in this report and reported at the RSG workshop, can significantly improve the outcome of the current officer selection practice.
Author
Personnel Selection; Decision Making

20010056517 Institut de Medicine Aerospatiale Armee, Bretigny sur Orge, France
PSYCHOLOGICAL CONSEQUENCES
Grau, J. Y., Institut de Medicine Aerospatiale Armee, France; Human Consequences of Agile Aircraft; May 2001, pp. 39-48; In English; See also 20010056513; Copyright Waived; Avail: CASI; A02, Hardcopy

The technological design and developments already applied to a number of aircraft, which represent the basis of tomorrow's aircraft, tend to change the tasks performed by pilots. Since the 80s, automation and computerization have invaded cockpits, leading to a change in the role of pilots. Whereas pilots used to need competencies directed towards handling and navigating the aircraft, what is now increasingly required of them is the ability to manage complex systems. With the arrival of new concepts like supermaneuverability and superagility, it seems extremely important to try and understand the psychological consequences these concepts will have on pilots. Enabling new types of operation, supermaneuverability and superagility alter existing tasks and will probably create new ones, which will have their own psychological constraints. What makes these constraints different from those existing on present aircraft, and what consequences could they have on pilot performance? These two questions can be addressed by two preliminary comments: (1) As of today, supermaneuverability and superagility are still extremely novel concepts. Various prototype aircraft point to the developments, which will eventually make these concepts a reality in the near future, but there still is no such thing as real operational experience. The difficulty in accurately studying the consequences these future aircraft will have on pilots, lies in trying to define the exact role the pilot will be asked to play aboard; and (2) The psychological consequences studied will be limited to the consequences borne by the pilot in terms of taking and processing information. This chapter does not take into account psychological aspects based on personality or motivation. The definition of supermaneuverability and superagility, or rather agility, gives rise to two fields of investigation regarding psychological consequences. These fields, far from being independent from each other, must be combined to clearly describe the psychological consequences borne by pilots. But, for clarity and comprehensiveness, it is best to study them separately, initially. The first one, supermaneuverability, refers to aircraft aerodynamic capacities. The psychological effects on pilots generated by the physiological stress resulting from this capacity need to be studied. The second one, agility, is connected to the operational capacities of these aircrafts. The aircraft must be assessed as an element within a global system, where it is a vehicle laden with on-board systems helping it achieve its mission in an operational environment.
Author
Complex Systems; Pilot Performance; Psychological Effects; Maneuverability

20010056520 Swedish Armed Forces, Aeromedical Center, Stockholm, Sweden
SELECTION AND TRAINING
Linder, J., Swedish Armed Forces, Sweden; Tielemans, W., Royal Netherlands Air Force, Netherlands; Human Consequences of Agile Aircraft; May 2001, pp. 99-110; In English; See also 20010056513; Original contains color illustrations; Copyright Waived; Avail: CASI; A03, Hardcopy

A superagility training structure is discussed and presented. The agile pilot will in the new superagility arena be clearly dependent on both old training principles but also on training where some new interacting factors might come into play: (1) Selection plays a major role with physiological, intellectual and stress management resources; (2) Certain human constraints like musculoskeletal, cardiovascular, respiratory, sensory and mental are discussed; (3) Normal life and regular training do also have a definite implication also on

flying; (4) Specific single task training where a pilot trains crucial abilities like G-tolerance, back/neck-tolerance and hypobarics. Today there is a lack in this area of specific training. Training devices for pilots regarding the sensory system and the cognitive performance are discussed; (5) Specific combined tasks training where the pilot have to train in a more complex way, e.g., survival training or mission scenarios in a Multi Mission Trainer (MMT); and (6) Full ground mission task where the pilot uses a Full Mission Simulator (FMS) or a Dynamic Flight Simulator (DFS). Some parts of the Superagility Training Structure have not been a scope in this chapter. They are therefore briefly mentioned here.
Author
Training Devices; Pilot Training; Pilot Selection; Physiological Factors

20010056525 Ponomarenko (V.), Moscow, Russia
PSYCHOPHYSIOLOGICAL PROBLEMS OF MODERN AND FUTURE AVIATION, APPENDIX C
Ponomarenko, V., Ponomarenko (V.), Russia; Human Consequences of Agile Aircraft; May 2001, pp. 149-154; In English; See also 20010056513; Copyright Waived; Avail: CASI; A02, Hardcopy

Aviation medicine keeps under observation, explores, and studies human beings on the verge of their capabilities in a hostile environment, where they display not only spiritual greatness and corporal strength, but disintegration of whole somatic systems. Psychophysiology shapes and changes the qualities of the organism and personality, his physical, psychological, ethical, and moral sources, which dictates that the pilot be fitted to flying activity in 20-25 years and to reach his peak during 20-25 years of life. Naturally, aviation medicine is involved in the course of aviation technologies research and development, technical learning devices, means and methods of psychophysiological training, formation of methods for health protection, maintenance of high performance, and effectiveness and prolongation of flying longevity. It follows that aviation medicine, in contrast to more technical disciplines, appears to be an integral one because this branch ensures human factors in all diversity of interactions with machines, control, communication, training, learning. The quintessence of the practical side of this science comes to flying safety problems solutions. This task may be solved at two levels: subject-functional and system-purposeful. The subject-functional level is limited by traditional medico-hygienic problems of human life support systems in aircraft cockpits. The system-purposeful level presupposes the investigations based on human performance principle with consideration of pilot-aircraft system interaction in the process of professional tasks fulfillment.
Derived from text
Aerospace Medicine; Human Factors Engineering; Psychophysiology

20010076811 Royal Netherlands Navy, Diving Medical Center, Den Helder, Netherlands
NEUROPSYCHOMETRIC TEST IN ROYAL NETHERLANDS NAVY MINE-CLEARANCE DIVERS
vanHulst, R. A., Royal Netherlands Navy, Netherlands; Emmen, H. H., Institute for Nutrition and Food Research TNO, Netherlands; Muijser, H., Institute for Nutrition and Food Research TNO, Netherlands; Operational Medical Issues in Hypo- and Hyperbaric Conditions; June 2001, pp. 9-1 - 9-4; In English; See also 20010076799; Copyright Waived; Avail: CASI; A01, Hardcopy

In recent years, there has been growing concern within the diving community that divers may be suffering long-term neurological damage. Neurological changes may exist either as clinical manifestations or as silent asymptomatic abnormalities only demonstrated by neurological and neuropsychological techniques. The aim of this study was to investigate possible neuropsychometric effects in Netherlands Navy mine-clearance divers without any previous neurological decompression sickness.
Author
Diving (Underwater); Neurology; Damage

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MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

19990092805 Research and Technology Organization, Systems Concepts and Integration, Neuilly-sur-Seine, France
SENSOR DATA FUSION AND INTEGRATION OF THE HUMAN ELEMENT *[LA FUSION DE DONNEES DE SENSEUR ET L'INTEGRATION DU FACTEUR HUMAIN]*
February 1999; 244p; In English; 14-17 Sep. 1998, Ottawa, Ontario, Canada; See also 19990092806 through 19990092825; Original contains color illustrations
Report No.(s): RTO-MP-12; AC/323(SCI)TP/4; ISBN 92-837-1010-X; Copyright Waived; Avail: CASI; A11, Hardcopy; A03, Microfiche

This volume contains the Technical Evaluation Report, the Opening Address, the Keynote Address and the 20 unclassified papers, presented at the Systems Concepts and Integration (SCI) Panel Symposium held in Ottawa, Canada from 14th to 17th September 1998. The papers presented covered the following headings:(1) Characteristics of Operational Requirements; (2) System Design Techniques and Technologies; (3) Integration of Human Operators with Complex Systems; (4) System Applications; and (5) Lessons Learned and Future Trends.
Author
North Atlantic Treaty Organization (NATO); Research And Development; Conferences; Multisensor Fusion; Algorithms; Human-Computer Interface; Systems Engineering; Complex Systems

19990092806 Hochschule der Bundeswehr, Inst. for Systemdynamic and Flightmechanic, Munich, Germany
INTELLIGENT CREW ASSISTANT FOR MILITARY TRANSPORT AIRCRAFT
Walsdorf, Anton, Hochschule der Bundeswehr, Germany; Onken, Reiner, Hochschule der Bundeswehr, Germany; Sensor Data Fusion and Integration of the Human Element; February 1999, pp. 1-1 - 1-7; In English; See also 19990092805; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

Modern cockpit environments, covering highly integrated and complex automatic functions, pose various demands on the crew. In unusual situations the crew often is overtaxed and acts erroneously 'Clumsy automation' is considered to be a major reason for deficiencies concerning the interaction between cockpit crew and aircraft systems. Cognitive systems appear to be a promising approach to overcome these deficiencies in capabilities in the interpretation and diagnosis of the situation, planning and decision making and the execution of a plan. In this paper a general survey on the principals of cognitive cockpit assistance will be given. Demands and requirements for an appropriate automation and a generic functional structure of a cognitive assistant system will be introduced. A prototype system, the Crew Assistant MIlitary Aircraft (CAMA) its capabilities and function units (modules) are presented and described in detail. In future combat transport aircraft, constraints created by low level flying in a high risk theater, the high rate of change of information and short reaction times required will produce physiological and cognitive problems for pilots. CAMA is designed taking into consideration the approach of human-centered automation.
Author
Cockpits; Fighter Aircraft; Flight Crews; Transport Aircraft; Decision Support Systems; Pilot Support Systems; Aircraft Equipment

19990092818 Elektroniksystem- und Logistik G.m.b.H., Experimental Avionics Systems, Munich, Germany
EVALUATION OF THE COCKPIT ASSISTANT MILITARY AIRCRAFT CAMA IN SIMULATOR TRIALS
Schulte, Axel, Elektroniksystem- und Logistik G.m.b.H., Germany; Stuetz, Peter, Universitaet der Bundeswehr Muenchen, Germany; Sensor Data Fusion and Integration of the Human Element; February 1999, pp. 16-1 - 16-8; In English; See also 19990092805; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

Inappropriate automation is considered to be a major reason for deficiencies on interaction between pilot crew and aircraft systems. The lack of situation awareness is pointed out to be a crucial cause of pilot failure. Because of this, cockpit assistant systems are being developed in support of human-centered automation. CAMA assists

military crews during transport missions. This paper consists of three main parts, briefly describing the functional prototype of CAMA, the experimental means taken in order to evaluate the integrated system, and the comprehensive results of two flight simulator campaigns. Firstly, a general survey is given on human factors related problems in this particular domain. Their influence on the principles of cockpit crew assistance will be shown and a brief circumscription of CAMA's main functionalities follows. The description of the simulator facilities for experimentation includes the visual system, the available flight controls and the means for interaction between the pilot and CAMA. The experimental scenario and tasks are pointed out. To get an estimation on the pilot's overall acceptance of the approach and the benefits of the CAMA system, thorough evaluations were conducted.
Author
Human Factors Engineering; Pilot Support Systems; Avionics; Military Aircraft; Aircraft Equipment; Flight Instruments; Pilot Performance

19990092819 Defence Evaluation Research Agency, Systems Integration Dept., Farnborough, UK
FUSION AND DISPLAY OF TACTICAL INFORMATION WITHIN BATTLEFIELD HELICOPTERS
Watts, Anna, Defence Evaluation Research Agency, UK; Silvester, Clare, Defence Evaluation Research Agency, UK; Sensor Data Fusion and Integration of the Human Element; February 1999, pp. 17-1 - 17-5; In English; See also 19990092805; Copyright Waived; Avail: CASI; A01, Hardcopy; A03, Microfiche

Battlefield helicopters will form an important element of the digitized Battlespace. Helicopter aircrew will be presented with large amounts of data from both on board sensors and other units. The way in which this information is presented to the crew will have a critical impact on operational effectiveness. This paper describes the trial carried out by the Defense Evaluation and Research Agency (DERA) for the UK MoD to assess the impact of providing Tactical Situation Displays (TSD) of varying degree of data fusion and complexity. Previous trials, assessed the impact on operational effectiveness of the provision of tactical information in the helicopters. These concluded that the provision of tactical information improved operational effectiveness, survivability and situational awareness. Instances of fratricide reduced dramatically. These parameters improved still further when on board sensor data was fused with the tactical display. The two previous trials were undertaken prior to the selection of the WAH-64 as the UK Army's Attack helicopter. It was considered important to re-assess the conclusions of the earlier trials in the light of the capabilities of the WAH-64. This trial was designed to assess the effect on operational effectiveness of providing on-board tactical information displays of varying degrees of integration to the Commander of the WAH-64, A fourth trial, due to take place in 1998 will examine the impact of different levels and accuracies of tactical information.
Author
Display Devices; Multisensor Fusion; System Effectiveness; Military Helicopters

19990092824 Air Force Research Lab., Wright-Patterson AFB, OH USA
INTEGRATING VOICE RECOGNITION AND AUTOMATIC TARGET CUEING TO IMPROVE AIRCREW-SYSTEM COLLABORATION FOR AIR-TO-GROUND ATTACK
Barbato, Greg, Air Force Research Lab., USA; Sensor Data Fusion and Integration of the Human Element; February 1999, pp. 24-1 - 24-11; In English; See also 19990092805; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

Automatic target cueing and pilot voice recognition were integrated into a single-seat fighter cockpit simulator and were evaluated. Pilots were required to fly a pre-planned route to an airfield, where the identified and designated for attack, six tanker aircraft from a group of fifteen aircraft that were parked on the airfield. During navigation and weapon delivery segments of the mission simulated Airborne Warning and Control directed the pilots to: (1) modify their flight route, (2) change radio frequencies, (3) respond to various tasks and instructions and (4) attack the airfield. During half of the data collection sessions data input tasks were performed manually by the pilots using an upfront keypad; during the other half of the sessions, data input was accomplished by voice. Additional independent variables were: (1) auditory interference--number of communications requiring pilot response, and (2) workload -- maintain altitude, at either 300 feet or 10900 feet above ground level. Objective measures of performance for data input (speed and accuracy) and for aircraft control (deviations from command course airspeed and altitude were collected while pilots navigated along the fight route. Objective measures collected during ground attack, included speed of target designation, total number of targets correctly designated, and stand-off distance from the airfield at target designation.
Author
Aircraft Control; Attack Aircraft; Cockpit Simulators; Target Recognition; Weapons Delivery; Voice Control; Voice Data Processing

19990092825 Naval Air Warfare Center, Weapons Div., China Lake, CA USA
THE EFFECTS OF IMAGE RESOLUTION ON THE UTILITY OF TARGET RECOGNITION AIDS
Stiff, Jan, Naval Air Warfare Center, USA; Sensor Data Fusion and Integration of the Human Element; February 1999, pp. 26-1 - 26-7; In English; See also 19990092805; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

To enable aircraft to respond to time-critical targets during a mission, efforts are underway to develop systems that provide pilots access to imagery-based information from offboard sources. Previous research has shown that annotated imagery of the target area improves target recognition and that the usefulness of Imagery Based Target Recognition Aids (IBTRAs) depends on factors such as viewpoint, image complexity and coverage. This report describes a study that compared the utility of IBTRAs generated from high resolution and low-resolution databases and identified the impacts of each on operator target recognition performance. Differences in performance were found for both the high- and low-resolution imagery caused by variations in the sensor distance from the target area caused by variations in the sensor distance from the target area and by the cross-range extent of the image. The best performance, both in speed and accuracy, was observed when the cross-range extent of the IBTRA was similar to that of the sensor image. IBTRAs developed from high-resolution data provided a significant increase in target recognition accuracy at all reference image cross range extents when used with imagery taken close to the target. The operation significance of these findings is dependent on the scenario; for a weapon release relatively close to the target the use of IBTRAs generated from high-resolution data may be of greater value than for a weapon release from longer ranges. A model is presented that describes target recognition performance as a function of the cross-range extent of the imagery being used.
Author
Image Resolution; Imagery; Target Recognition; Targets

20000011738 Centre d'Etudes et de Recherches de Medecine Aerospatiale, Inst. de Medecine Aerospatiale, Bretigny sur Orge, France
PRACTICE OF A THEORY CONCEPT OF CRM (COCKPIT RESOURCE MANAGEMENT) TRAINING FOR EQUIPPING MILITARY HELICOPTERS *[DE LA THEORIE A LA PRATIQUE: CONCEPTION D'UN COURS CRM POUR LES EQUIPAGES D'HELICOPTERES MILITAIRES]*
Grau, J. Y., Centre d'Etudes et de Recherches de Medecine Aerospatiale, France; Derain, P., LEMP, France; Maugey, B., Centre d'Etudes et de Recherches de Medecine Aerospatiale, France; Valot, C., Centre d'Etudes et de Recherches de Medecine Aerospatiale, France; Seynaeve, A., COMALAT, France; Current Aeromedical Issues in Rotary Wing Operations; August 1999, pp. 3-1 - 3-8; In French; See also 20000011735; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

Cockpit Resource Management (CRM) is one of the ways available to improve flight safety. 'Human factors' training's are designed for military air crews hut due to the absence of international military regulation, there is a large variety of training goals and contents between countries. From the know-how acquired during the design of 'Puma' helicopter CRM, guidelines can he given lor 'human factors' training policy definition and CRM courses design. In conclusion data exchange between countries is proposed by the authors as as way way standardize 'human factors' training in order to

improve either flight safety and aircrew proficiency multinational missions.
Author
Military Helicopters; Cockpits; Human Factors Engineering; Resources Management; Pilot Training

20000011752 Naval Air Warfare Center, Crew Systems Dept., Patuxent River, MD USA
SAFETY OF FLIGHT AND ANTHROPOMETRY IN USA NAVY AIRCRAFT
Yauneridge, William, Naval Air Warfare Center, USA; Kennedy, Greg, Naval Air Warfare Center, USA; Current Aeromedical Issues in Rotary Wing Operations; August 1999, pp. 19-1 - 19-4; In English; See also 20000011735; Copyright Waived; Avail: CASI; A01, Hardcopy; A03, Microfiche

The US Navy initiated a tri-service effort in 1994 to standardize methods, agree on a population data set representative of the future Department of Defense aviator pool, and map current Navy aircraft cockpits to evaluate crew member accommodation. The Joint Primary Air Training System (JPATS) aircraft was specified to accommodate a much wider range of pilot body sizes than any other aircraft in USN/USAF (USA Navy/USA Air Force) history. The expansion of sizes was in both larger and smaller cockpit critical anthropometric dimensions. Because of the JPATS accommodation implications, initial USN emphasis was directed at the most critical aircraft deemed fighters. USN anticipated a concern for this expanded range of pilots to safely fly these aircraft and a need to re-engineer those aircraft to better meet a Congressional mandate for female accommodation. To address this safety concern the USN initiated the cockpit mapping effort to quantify safe pilot fit in all operational aircraft. USN performs three dimensional computer aided drafting (3D CAD) based cockpit measurements of the accommodation provided by aircraft and measures the clearances, reaches, and field of view for a range of individuals. The end products are: 1) Prediction equations that are used to determine a percentage of a target population that can be expected to be accommodated in a particular aircraft or aircraft pipeline. 2) Aircrew candidate selections for pipeline assignments based on achieving a suitable seat position.
Author
Navy; Anthropometry; Aircraft Pilots; Flight Safety; Armed Forces (United States); Defense Program; Training Aircraft

20000011758 Institute for Human Factors TNO, Dept. of Work Environment, Soesterberg, Netherlands
ERGONOMIC AND ANTHROPOMETRIC ISSUES OF THE FORWARD APACHE CREW STATION
Oudenhuijzen, A. J. K., Institute for Human Factors TNO, Netherlands; Current Aeromedical Issues in Rotary Wing Operations; August 1999, pp. 26-1 - 26-11; In English; See also 20000011735; Original contains color illustrations; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

This paper describes the anthropometric accommodation in the Apache crew systems. These activities are part of a comprehensive project, in a cooperative effort from the Armstrong Laboratory at Wright Patterson Air Force Base (Dayton, Ohio, USA) and TNO Human Factors Research Institute (TNO HFRI) in The Netherlands. The main objective of the project is to develop effective methods for anthropometric accommodation of crew systems, during the design process of military aircraft. As a part of this project the Royal Netherlands Airforce asked TNO for a brief examination of the anthropometric selection criteria used for selection of Apache pilots. The criteria were verified in this examination in order to check their validity and to check if more anthropometric selection criteria were needed.
Author
Anthropometry; Human Factors Engineering; Crew Workstations; Protective Clothing; Apache Rocket Vehicle; Design Analysis

20000011761 Defence Evaluation Research Agency, Systems Integration Dept., Farnborough, UK
HELMET MOUNTED DISPLAYS FOR THE 21ST CENTURY: TECHNOLOGY, AEROMEDICAL AND HUMAN FACTORS ISSUES
Rood, G. M., Defence Evaluation Research Agency, UK; duRoss, H., Defence Evaluation Research Agency, UK; Current Aeromedical Issues in Rotary Wing Operations; August 1999, pp. 29-1 - 29-7; In English; See also 20000011735; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

The introduction of Helmet Mounted Sights and Display's into operational aircraft, and the increased mass of the helmets due to the incorporation of the additional image source, optical trains, the combiners/projection system as well as the wiring optical supports etc, and the subsequent changes in centre-of-gravity have all conspired to push the biomechanical safety aspects in the wrong direction. Most current work is in minimizing the mass of these components and lowering the CofG of the head mounted mass by a number of clever design fixes, and this is producing some reductions in helmet or head-mounted mass. The average current flight helmets weigh in the region of 1.5kg (3.3lb), whilst the lightest is in the region of 1.1kg (2.5lb). In some cases these lower masses results in a reduction of impact protection and whilst in some cases, this may be acceptable for operational reasons, reduction in impact safety margins is not generally or widely acceptable. To complete the head mounted weight, the mass of an oxygen mask, at some 300g (0.66lb), must be added. Helmets incorporating displays are of course heavier and the current average mass, excluding oxygen mask, is in the region of 1.9kg, (4.2lb) and 2.2kg (4.8lb) with O2 mask gives an indication of the static loads on the head, counterbalanced by the posterior neck muscles. If the mass and balance targets of future Helmet Mounted Displays systems are to be met, then it is likely that new approaches to integrated helmet design need to be initiated, as the current approach with conventional flying helmets has obvious limitations. By the use of new materials and structures technology, lighter weight helmets can be designed and built that provide improved impact protection and stability, whilst reducing the risk of neck and spinal injury. Protection against the helicopter noise environment and improved communications can be accomplished by active noise reduction systems which are an integral part of the helmet design and this type of helmet design has the potential for incorporating fully integrated NBC (Nuclear Biological Chemical) protection.
Derived from text
Helmet Mounted Displays; Aerospace Medicine; Biodynamics; Human Factors Engineering; Flight Clothing; Structural Engineering; Mathematical Models

20000011763 Universal Energy Systems, Inc., Fort Rucker, AL USA
EFFECTS OF HEAD-SUPPORTED DEVICES ON FEMALE AVIATORS DURING SIMULATED HELICOPTER RIDES
Barazanji, K., Universal Energy Systems, Inc., USA; Alem, N., Army Aeromedical Research Lab., USA; Dodson, J., Universal Energy Systems, Inc., USA; Erickson, B., Army Aeromedical Research Lab., USA; Guerrero, R., Army Aeromedical Research Lab., USA; Reyes, S., Army Aeromedical Research Lab., USA; Current Aeromedical Issues in Rotary Wing Operations; August 1999, pp. 31-1 - 31-7; In English; See also 20000011735; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

Researchers at the U.S. Army Aeromedical Research Laboratory (USAARL) recently concluded that weight-moment of head-supported devices (HSDs) worn by male aviators should not exceed 80 Newton-centimeters (N-cm). The goal of this study was to define a safe range of weights and centers of mass of HSD that can be tolerated by female helicopter pilots without affecting their health or degrading their performance. Five subjects were exposed to whole-body vibration while wearing HSD with various mass properties. During exposure, biomechanical head acceleration response was recorded. Head pitch, anterior-posterior, and axial accelerations were measured for 12 different helmet configurations during sinusoidal vertical vibration having a magnitude of 0.45 m/s (exp. 2) and frequencies swept from 2 Hz to 17 Hz at the rate of 0.25 Hz/sec. Preliminary results indicate that head pitch and axial acceleration levels for female subjects were lower than those for their male counterparts. This may be attributed to gender differences in upper-body anthropometry. The standard deviation of female head accelerations was found to be similar to that of male subjects.
Author
Aerospace Medicine; Helicopters; Females; Aircraft Pilots; Helmets; Head (Anatomy); Biodynamics

20000011764 Army Aeromedical Research Lab., Fort Rucker, AL USA

PAST, PRESENT AND FUTURE NIGHT VISION GOGGLES IN US ARMY AVIATION

McLean, William E., Army Aeromedical Research Lab., USA; Rash, Clarence E., Army Aeromedical Research Lab., USA; Current Aeromedical Issues in Rotary Wing Operations; August 1999, pp. 32-1 - 32-15; In English; See also 20000011735; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

The Department of the Army (U.S.) decided to increase night operational effectiveness with night vision devices (NVDs) for use in aviation in 1973. The first fielded NVDs for Army aviation were developed for ground troops and were known as the full faceplate AN/PVS-5 night vision goggle (NVG). In the 25 years that have followed, a number of engineering advancements have greatly improved the performance and mechanical packaging of these devices. For approximately the last 10 years, pilots have been using 3' generation image intensifier (I') technology, which is known as the Aviator's Night Vision Imaging System (ANVIS). Although the basic principle of light amplification with a microchannel plate has not changed, the performance has and is due to the optimization of the components and the electronic designs. The latest NVD developments include wider fields of view (FOVs), increased resolution, reduced halos around lights, improved signal to noise ratios and low light performance. A prototype color vision device has also been demonstrated. This paper updates and condenses previous information on U.S. NVG history.

Author

Night Vision; Goggles; Armed Forces (United States); Helmet Mounted Displays; Head-Up Displays; System Effectiveness

20000011772 Army Aeromedical Research Lab., Fort Rucker, AL USA

AEROMEDICAL AND DESIGN ISSUES OF THE HELICOPTER AIRBAG RESTRAINT SYSTEM

McEntire, Joseph, Army Aeromedical Research Lab., USA; Current Aeromedical Issues in Rotary Wing Operations; August 1999, pp. 41-1 - 41-8; In English; See also 20000011735; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

Bodily contact with cockpit structure remains the leading cause of serious and fatal injury in survivable helicopter mishaps. As a countermeasure, the U.S. Army is developing a cockpit airbag system (CABS) for use in the UH-60 Black Hawk as a supplemental restraint system. This program was initially considered a technology transfer effort, transferring automotive airbag technology into the military helicopter cockpit. Unique helicopter crash kinematics caused the performance requirements to diverge from automotive requirements. As a result, many of the technical aspects of the airbag restraint system were readdressed, from airbag fabric selection to sensing the crash. Many design challenges remain, such as accommodating the smallest to largest occupants and determining the 'FIRE' thresholds. Finally, the method of assessing system effectiveness must be addressed. Various performance requirements, rationale, lessons learned, and operational issues of the cockpit airbag system are discussed.

Author

Aerospace Medicine; Air Bag Restraint Devices; Design Analysis; System Effectiveness; Uh-60a Helicopter

20000011773 Universal Energy Systems, Inc., Fort Rucker, AL USA

MASS AND LOCATION CRITERIA OF HEAD-SUPPORTED DEVICES USING ARTICULATED TOTAL BODY SIMULATIONS

Brozoski, Frederick T., Universal Energy Systems, Inc., USA; Mobasher, Amir A., Alabama A & M Univ., USA; McEntire, B. Joseph, Army Aeromedical Research Lab., USA; Alem, Nabih M., Army Aeromedical Research Lab., USA; Current Aeromedical Issues in Rotary Wing Operations; August 1999, pp. 42-1 - 42-10; In English; See also 20000011735; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

Limits on the mass of head-supported devices (HSDs) and center of mass location were investigated using the biodynamic response of occupant models during simulated helicopter crashes. The articulated total body (ATB) model was used to simulate five different crash pulses, three seat stroking distances, and three HSD masses with the mid-sized Hybrid III manikin as the occupant model. The centers of mass were placed at 49 positions in each of three planes: (1) the mid-sagittal plane of the head, (2) a plane located 3 centimeters to the right of the mid-sagittal plane, and (3) a plane 3 centimeters to the left of the mid-sagittal plane. Moments and forces produced by the ATB simulations at the head-neck interface (occipital condyles) were compared to established injury thresholds to determine the risk of neck injury. Acceptable combinations of head-supported masses and locations then were established for the given impact conditions. Acceptable HSD mass and location were highly dependent on impact condition and the seat stroke.

Author

Aircraft Accidents; Helmet Mounted Displays; Biodynamics; Flight Crews; Center Of Mass; Computerized Simulation; Bionics

20000011775 Manitoba Univ., Lab. for Exercise and Environmental Medicine, Winnipeg, Manitoba Canada

A PORTABLE RIGID FORCED-AIR WARMING COVER FOR PRE-HOSPITAL TRANSPORT OF COLD PATIENTS DURING ROTARY WING AIRCRAFT SEARCH AND RESCUE

Giesbrecht, Gordon G., Manitoba Univ., Canada; Pachu, Prithpal, Manitoba Univ., Canada; Xu, Xiao-Jiang, Manitoba Univ., Canada; Current Aeromedical Issues in Rotary Wing Operations; August 1999, pp. 25-1 - 25-3; In English; See also 20000011735; Copyright Waived; Avail: CASI; A01, Hardcopy; A03, Microfiche

Two rigid forced-air warming covers were designed to direct heat to the torso and thighs of normothermic subjects. Subjects were heated with an AC powered heater and either a commercial soft cover or the rigid covers (with the heat input at the head or abdomen). Compared to the soft cover, the rigid covers provided similar heat delivery but a higher mean skin temperature. This new heat delivery system combination may have practical value during evacuation of cold patients in rotary wing aircraft.

Author

Rotary Wing Aircraft; Coverings; Skin Temperature (Biology); Rescue Operations; Searching; Human Factors Engineering; Heating Equipment

20000032390 Naval Air Warfare Center, Crew Systems Research and Engineering Dept., Patuxent River, MD USA

COMPARISON OF VERTEBRAL STRENGTH PROPERTIES OF ANTHROPOMETRICALLY SIMILAR MALE AND FEMALE USING QUANTITATIVE COMPUTED TOMOGRAPHY

DiCuccio, M., Thomas Jefferson Univ., USA; Paskoff, G., Naval Air Warfare Center, USA; Whitley, P., M Technologies, Inc., USA; Schweitzer, M., Thomas Jefferson Univ., USA; Models for Aircrew Safety Assessment: Uses, Limitations and Requirements; August 1999, pp. 2-1 - 2-6; In English; See also 20000032388; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

In determining the risk of injury in the military aviation environment, a male and female of the similar height and weight have been assumed to have the same risk of vertebral injury during an escape or crash scenario. A Quantitative Computed Tomography (QCT) study has been performed to analytically quantify the vertebral strength properties between men and women. The study's goals were to examine the vertebral geometry, bone density, end-plate cortical bone thickness, and trabecular bone architectures of the C2, C5, T12 and L4 vertebrae for a subjects pool that consisted of 25 males and 25 females. Additionally, the development of a multivariant regression equation, which would predict the risk of vertebral injury for all individuals and would serve as a guide for designing escape and crash protection systems, was initiated. Preliminary analysis revealed that C2 and C5 trabecular bone mineral densities (BMD mg K2HPO4/cc) were significantly higher than those for T12 and L4. When separated by gender the same site relationship held. Female C2 and CS trabecular bone mineral densities were significantly higher than those for males. Preliminary analysis of gender comparison of endplate cross-sectional area, area density (cross-sectional area x BMD) and predicted strength for the L4 vertebrae revealed that only endplate cross-sectional area was significantly different.

Author

Females; Males; Vertebrae; Crashes; Human Tolerances; Injuries; Tomography; Quantitative Analysis; Anthropometry

20000032391 North Dakota State Univ., Impact Biomechanics Lab., Fargo, ND USA
MODES OF HUMAN HEAD/NECK RESPONSE TO VERTICAL IMPACT
Ziejewski, Mariusz, North Dakota State Univ., USA; Obergefell, Louise, Air Force Research Lab., USA; Perry, Chris, Air Force Research Lab., USA; Anderson, Beth, Veridian, USA; Models for Aircrew Safety Assessment: Uses, Limitations and Requirements; August 1999, pp. 3-1 - 3-10; In English; See also 20000032388; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

Helmet-mounted systems can change the helmet's mass inertial properties such as weight, moment of inertia, and center of gravity location, this change may alter the head/neck response and possibly change the pattern of neck loading during the catapult phase of ejection (i.e. vertical impact phase). To define the specifications or criteria for allowable head mounted mass and center of gravity location that is safe for the crew members, identification of the head/neck responses and the factors influencing those responses is necessary. The objectives of this study were to identify the modes of head/neck response to vertical impacts, to determine and assess the parameters influencing head/neck response, and to determine a method of predicting mode of head/neck response for a given subject under given conditions. The data used in this study came from five test cells of the Female Impact Program (FIP) study performed at the Air Force Research Laboratory (AFRL) on their Vertical Deceleration Tower (VDT) facility at Wright Patterson Air Force Base, Dayton, Ohio. The subjects were exposed to acceleration levels comparable to those experienced in the catapult phase of ACES II ejections. The peak acceleration level for the tests used in this study was 10 G. Each of the subjects wore the same type of helmet. However, the inertial properties of the helmet were varied to simulate those of current helmet-mounted systems. Five modes of head/neck response for vertical impact were identified and characterized. Modes A and B represent forward neck and head rotation. Modes C and D represent forward neck rotation and rearward head rotation. Mode E of head/neck response represent no significant neck or head rotation. Two experimental parameters, namely, linear x-acceleration of the head at the mouthpiece and head pitch as measured by the motion of the mouthpiece LED with respect to the shoulder LED, were found to be sufficient to uniquely define the mode of head/neck response. Three categories of parameters have been identified and suggested to be the determining factors in a given subject's mode of response for a given condition. The categories include initial position, anthropometry, and other factors such as helmet, weight, helmet center of gravity location and impact acceleration level.
Author
Anthropometry; Impact Acceleration; Physiological Responses; Helmets; Head (Anatomy); Neck (Anatomy); Injuries; Gravitational Effects; Crews

20000032392 Biodynamic Research Corp., San Antonio, TX USA
A PC-BASED HEAD-SPINE MODEL
Bomar, John B., Jr., Biodynamic Research Corp., USA; Pancratz, David J., Biodynamic Research Corp., USA; Models for Aircrew Safety Assessment: Uses, Limitations and Requirements; August 1999, pp. 4-1 - 4-11; In English; See also 20000032388; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

Biodynamic Research Corporation (BRC) of San Antonio, TX, completed a government-sponsored project to port the Air Force's Head-Spine Model (HSM) to a personal computer environment, improve certain features of the software, and add a user-friendly interface. The impetus for this project was the desire to have a software tool capable of modeling the internal forces and motions of the human head and spine during impulsive acceleration events, such as aircraft ejections. The HSM was originally developed in the 1970's over a period of several years. BRC re-coded the model using modern programming techniques and renamed the software HSM-PC. The HSM-PC is a collection of rigid inertial elements and massless deformable elements that represent the anatomy of the human spine. There are multiple versions of the model, with increasing levels of complexity, The HSM-PC simulation program consists of a graphical user interface, a computational module, and a database. The geometry and biomechanical data for the model are stored in Microsoft Access format, and can be viewed from the HSM-PC software or from Access directly. The user interface permits an operator to select different HSM models for a simulation; permits editing of the environment, or simulation parameters; and then allows the user to visually review the results of a simulation through an animation or graphs of desired data. The software stores element, environment, simulation, and other data in separate text files, so that additional simulations with a different environment, different forcing functions, or different body elements can be quickly accomplished. The software runs on Microsoft Windows 95, 98, or NT, and requires a Pentium CPU or equivalent for reasonable operation. It is BRC's belief that there are still sections of the HSM-PC that must be improved to create a validated biomechanical tool with commercial potential. For example, old input files for the original HSM software were noted to have different element properties than published technical reports and journal articles. In many cases, the differences were several orders of magnitude. In addition, the original HSM software did not provide for a way to pre-load the elements of the model. BRC has introduced the concept of 'settling' into the HSM-PC, so that the elements of the model have realistic forces and moments acting on them at the start of the simulation. Finally, the element models can be improved significantly. In particular, the muscle and intervertebral disc model can be improved to be more realistic.
Author
Computerized Simulation; Personal Computers; Head (Anatomy); Biological Models (Mathematics); Biodynamics; Impact Acceleration; Spine; Environment Simulation

20000032393 Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek, Crash-Safety Research Centre, Delft, Netherlands
NECK PERFORMANCE OF HUMAN SUBSTITUTES IN FRONTAL IMPACT DIRECTION
Wismans, J. S. H. M., Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek, Netherlands; vandenKroonenberg, A. J., Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek, Netherlands; Hoofman, M. L. C., Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek, Netherlands; vanderHorst, M. J., Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek, Netherlands; Models for Aircrew Safety Assessment: Uses, Limitations and Requirements; August 1999, pp. 5-1 - 5-6; In English; See also 20000032388; Original contains color illustrations; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

In the past several laboratories have conducted human subject tests in order to derive biofidelity performance requirements for crash dummies and computer models. Both human volunteer and human cadaver tests have been conducted. Particularly noteworthy are the human volunteer tests conducted at the Naval Biodynamics Laboratory (NBDL) in New Orleans. In an extensive test program a large number of human subjects were exposed to impacts in frontal, lateral, and oblique directions. Detailed analyses of these tests have been conducted and presented in various publications. Based on these results, a set of biofidelity performance requirements was developed. These requirements include trajectories and rotations of the head as well as acceleration requirements and data on the neck loads. The objective of this paper is to compare the performance of various human neck models with the observed response in the volunteer tests. Concerning mechanical models, the neck of the Hybrid III dummy, which is the dummy currently specified in motor vehicle safety regulations, as well as the neck of the new THOR dummy will be evaluated. It will be shown that the neck of the THOR dummy offers more biofidelity than the Hybrid III dummy neck. Regarding mathematical neck models, a neck model developed in the MADYMO crash simulation program will be evaluated. It will be shown that the mathematical model which includes a representation of vertebrae, ligaments, and active muscle response is able to reproduce the observed human subject response more accurately than the available mechanical models.
Author
Biodynamics; Computerized Simulation; Neck (Anatomy); Impact Tests; Dummies; Mathematical Models; Human Beings; Impact Loads; Modal Response

20000032394 Simula Technologies, Inc., Phoenix, AZ USA
VALIDATION OF THE MADYMO HYBRID II AND HYBRID III 50TH-PERCENTILE MODELS IN VERTICAL IMPACTS
Manning, J. E., Simula Technologies, Inc., USA; Happee, R., Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek, Netherlands; Models for Aircrew Safety Assessment: Uses, Limitations and Requirements; August 1999, pp. 6-1 - 6-30; In English; See

also 20000032388; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

This paper describes the results of a project conducted by Simula Technologies, Inc., and TNO to validate TNO computer models of 50th-percentile Hybrid II and Hybrid III test dummies when used in a vertical crash condition. Drop tests were conducted at Simula utilizing military impact conditions for helicopter seat certification. After the tests were conducted, computer models of the simulation were made using the MADYMO 3D Crash Victim Simulation program and the test results were compared. The model showed good correlation to the tests in the parameters of interest.
Author

Computerized Simulation; Dummies; Seats; Drop Tests; Crashes; Biological Models (Mathematics); Computer Programs; Dynamic Tests

20000032395 Air Force Research Lab., HEPA, Wright-Patterson AFB, OH USA

STRENGTH OF THE FEMALE UPPER EXTREMITY

Pellettiere, J. A., Air Force Research Lab., USA; Duma, S. M., Virginia Univ., USA; Bass, C. R., Virginia Univ., USA; Crandall, J. R., Virginia Univ., USA; Models for Aircrew Safety Assessment: Uses, Limitations and Requirements; August 1999, pp. 7-1 - 7-12; In English; See also 20000032388; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

A dynamic injury tolerance for the female upper extremity was derived from dynamic drop tests onto female cadaveric limbs. Twelve female humeri were tested at a strain rate of 3.7 +/- 1.3 strain/second. The ultimate failure moment (mass scaled to a 5% female) was measured to be 128 +/- 19 Nm. Ten female forearms were tested at a strain rate of 3.94 2.0 strain/second. The ultimate failure moment (mass scaled to a 50% female) was measured to be 58 +/- 12 Nm. A finite element model of the female forearm was constructed from computed tomography data. These data were the basis for the construction of the geometry of the female radius and ulna. A material model previously developed for modeling the mechanical behavior of bone under a variety of loading conditions was applied. Bending simulations of the radius and ulna, both quasi-static and dynamic, were computed, with the results comparing favorably with values available from the literature. Both the model and the testing show that the female forearm is stronger in a supinated (palm up) position than the pronated (palm down) position. The computer modeling demonstrates that with this material model, it is possible to create finite element models of human long bones for the purpose of using them in computational codes for predicting their strength.
Author

Females; Computerized Simulation; Strain Rate; Mathematical Models; Injuries; Dynamic Tests; Bones; Human Tolerances; Finite Element Method

20000032396 Air Force Research Lab., HESA, Wright-Patterson AFB, OH USA

MILITARY APPLICATION OF BIODYNAMICS MODELS

Obergefell, Louise, Air Force Research Lab., USA; Rizer, Annette, Veridian, USA; Ma, Deren, Veridian, USA; Models for Aircrew Safety Assessment: Uses, Limitations and Requirements; August 1999, pp. 8-1 - 8-4; In English; See also 20000032388; Copyright Waived; Avail: CASI; A01, Hardcopy; A03, Microfiche

The Air Force Research Laboratory makes extensive use of biodynamics models to evaluate crew system designs and modifications, develop safe design criteria, and predict crewmember response. When special equipment is added to a cockpit for a test program, the Articulated Total Body (ATB) model is used to predict the crewmembers motion during an ejection. By simulating a large crewmember ejecting with his hands both on the firing control panel and on the side seat panel, the risk of significant arm contact is predicted. When the Army is concerned about detonating an item carried by a soldier during a fall from a truck or a parachute landing, the ATB model is used to predict the contact forces on the soldier if they land on a hard surface. When initial ejection seat tests with a new manikin have unusual results, biodynamics modeling is used to help sort out whether the response is due to the seat design or the manikin. Simulations of the tests with possible seat and manikin modifications are used to determine which modifications are most likely to improve results and to narrow future testing requirements. When ejection tests result in extreme manikin leg flail, ATB simulations are used to determine the loads in the hips, which are not measured by the manikin. The process used within AFRL to apply biodynamics modeling to these applications is described and the results presented.
Author

Biodynamics; Biological Models (Mathematics); Computerized Simulation; Crews; Escape Systems; Safety Factors; Design Analysis; Crashes; Dynamic Models; Human Factors Engineering

20000032397 Veridian, Systems Analysis and Research, Dayton, OH USA

CONTINUED DEVELOPMENT OF AN INTEGRATED EASY5/ ACESII-ATB MODEL FOR EJECTION SEAT SIMULATION

Ma, Deren, Veridian, USA; Obergefell, Louise A., Air Force Research Lab., USA; Rogers, Lawrence C., Aeronautical Systems Div., USA; Rizer, Annette L., Veridian, USA; Models for Aircrew Safety Assessment: Uses, Limitations and Requirements; August 1999, pp. 9-1 - 9-9; In English; See also 20000032388; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

This paper presents continued development and validation of an integrated ejection/crewmember model, specifically the modeling of aerodynamic effects and the crewmember/seat separation process. In a previous study, an ejection seat model, EASY5/ACESII (Engineering Analysis SYstem/Advanced Concept Ejection Seat), was coupled with a crewmember model, the ATB (Articulated Total Body) model. In this study, newly developed algorithms were incorporated into the integrated model to simulate the aerodynamics and seat/crewmember separation. Wind tunnel data from the ejection seat module are used to obtain total aerodynamic forces on the seat/crewmember combination. The crewmember module then uses an analytical method, based on air pressure and the exposed surface area, to calculate the aerodynamic forces and torques applied to the crewmember's individual body segments. These body forces and torques are then subtracted from the total forces and torques to obtain the force components applied directly to the seat in the ejection seat module. Once the man/seat separation signal is initiated, the aerodynamic forces and torques are applied only to the crew member. Dynamic interaction between the seat and crewmember during the very short period of their separation is complex and critically important. In this study, the harness release and crewmember/seat separation process algorithms were designed and implemented. When the release signal of the harness restraint is generated in the ejection seat module, it is transferred to the crewmember module. The harness belt in the crewmember module is then cut off. Meanwhile, the recovery parachute force from the ejection seat module is sent to the crewmember module. The combined forces due to gravity, recovery parachute, and aerodynamics separate the ejection seat and crewmember. Simulations of F-16/ACESII sled tests were carried out to validate the newly developed features in the integrated model. Simulation results are reported and compared with results of ejection seat sled tests. The validation shows that the model successfully predicts the major features of the ejection seat motion and the crewmember biodynamic responses.
Author

Aerodynamic Forces; Ejection Seats; Escape Systems; Crews; Torque; Computerized Simulation; Mathematical Models; Physiological Responses; Biodynamics

20000032398 JAYCOR, San Diego, CA USA

HEAD PROTECTION AGAINST WINDBLAST FOR CREW ESCAPE

Chan, Philemon C., JAYCOR, USA; Yu, James H.-Y., JAYCOR, USA; Stuhmiller, James H., JAYCOR, USA; Models for Aircrew Safety Assessment: Uses, Limitations and Requirements; August 1999, pp. 10-1 - 10-15; In English; See also 20000032388
Contract(s)/Grant(s): F41624-95-C-6014; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

A pilot ejecting from an aircraft at high speed faces the possibility of windblast head/neck injury. To establish a phenomenological understanding of windblast protection for the head, three stagnation concepts, the unvented fence, the hood and the brim have been evaluated. As tested in the wind tunnel, the unvented fence and hood produce overstagnation which may subject the head to unwanted oscillations. The vented hood and the brim can reduce the normal head force without overstagnation, but with a significant increase of side head force. The side head force increase is caused by windward headrest flow stagnation, as confirmed by computa-

tional fluid dynamics simulations and subscale water tunnel model testing. Studies were performed to reduce the head rest flow stagnation using the open brim concept.
Author
Head (Anatomy); Blasts; Ejection Injuries; Escape Systems; Safety Devices; Neck (Anatomy); Protection; Water Tunnel Tests; Scale Models

20000032399 George Washington Univ., National Crash Analysis Center, Ashburn, VA USA
THE USE OF COMPUTER FINITE ELEMENT MODELS OF HUMANS AND CRASH TEST DUMMIES FOR HIGH ACCELERATION AND IMPACT BIOMECHANICS STUDIES
Digges, Kennerly H., George Washington Univ., USA; Bedewi, Paul G., George Washington Univ., USA; Models for Aircrew Safety Assessment: Uses, Limitations and Requirements; August 1999, pp. 11-1 - 11-14; In English; See also 20000032388; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

The application of computer finite element models provides a valuable method for the study of human injury. The ability to model the complete human body is currently impractical. However, it is possible to model elements of the human body. These elements may be used independently, or in conjunction with models of crash dummies. In the latter case, specific crash dummy elements are replaced with human elements. The resulting model increases the accuracy of the model in predicting human response in high acceleration impacts. The procedure for applying human elements to crash test dummy models is illustrated by substituting human lower limbs on a finite element model of the Hybrid III dummy. The model is validated by replicating tests of human cadaver lower limbs. The model is then applied to predict the effect of muscle activation.
Author
Biodynamics; Finite Element Method; Human Body; Mathematical Models; Crashes; Dummies; Impact Acceleration

20000032401 Technische Univ., Eindhoven, Netherlands
MADYMO VALIDATION OF SIDE FACING SOFA SLED TESTS
Teulings, A. M. G. L., Technische Univ., Netherlands; Gowdy, V., Civil Aeromedical Inst., USA; Wismans, J. S. H. M., Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek, Netherlands; Aljundi, B., Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek-MADYMO North America, USA; Models for Aircrew Safety Assessment: Uses, Limitations and Requirements; August 1999, pp. 13-1 - 13-9; In English; See also 20000032388; Original contains color illustrations; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

In order to investigate and ultimately improve the crash worthiness of side facing sofas a series of sled tests were performed. The EUROSID-1 dummy was used to measure various signals needed to assess injury potential. To facilitate a parametric study into injury potential related factors a MADYMO computer model of these tests was made and needed to be validated. The correlation between test and simulation signals warrents sufficient turst in the model for it to he used as a baseline model in a parametric study.
Author
Computerized Simulation; Crashworthiness; Injuries; Crashes; Seats; Impact Tests; Dummies; Safety Management

20000032406 Defence and Civil Inst. of Environmental Medicine, Toronto, Ontario Canada
HIERARCHICAL MODELING OF THE BARORECEPTOR RESPONSE TO GZ ACCELERATION AND ANTI-GZ PROTECTIVE EQUIPMENT
Fraser, W. D., Defence and Civil Inst. of Environmental Medicine, Canada; Models for Aircrew Safety Assessment: Uses, Limitations and Requirements; August 1999, pp. 19-1 - 19-5; In English; See also 20000032388; Copyright Waived; Avail: CASI; A01, Hardcopy; A03, Microfiche

The use of extended coverage anti-G suits and positive pressure breathing have enhanced the protection of aircrew exposed to high Gz and extreme altitudes. However, current systems do not provide optimal protection to the individual pilot during complex negative-to-positive Gz maneuvers nor do such systems adapt to changes in the physiological state of the pilot over the course of the mission, in part due to the hardware's inability to adapt to the complex response of the blood pressure regulating systems within the body. Current, medically relevant models of baroreceptor function are not suitable for the extreme changes in blood pressure and blood distribution in a body exposed to very high Gz levels of the tactical environment. Using a mix of first principle and data driven techniques, we are developing hierarchical models of baroreceptor function that include the interaction between the neuronal subcomponents of the baroregulation centers of the central nervous system, the transient dynamics of pressure induced stretch in the baroreceptor organs, the effects of local pressure gradients within the aortic/carotid baroreceptor system, and the dynamic response of each of the subsystems during Gz exposures. All of these factors play a significant role in the individual's response to the Gz forces and the efficacy of the life support systems in preventing an adverse impact on cerebral blood flow and oxygenation of the brain.
Author
Baroreceptors; Acceleration Stresses (Physiology); Acceleration Protection; Pressure Breathing; Neurophysiology; Flight Crews; Acceleration Tolerance; Gravitational Effects; Pressure Suits

20000032407 Defence and Civil Inst. of Environmental Medicine, Toronto, Ontario Canada
MODELING OF THE PHYSIOLOGICAL RESPONSES TO NON-LINEAR G-SUIT AND POSITIVE PRESSURE BREATHING SCHEDULES
Fraser, W. D., Defence and Civil Inst. of Environmental Medicine, Canada; Lu, Z., Engineering Services, Inc., Canada; Askari, V., Engineering Services, Inc., Canada; Kapps, A., Engineering Services, Inc., Canada; Models for Aircrew Safety Assessment: Uses, Limitations and Requirements; August 1999, pp. 20-1 - 20-8; In English; See also 20000032388; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

Heart level blood pressure responses to G-suit pressures (2-8 psi) with and without Positive Pressure Breathing (5-60 mm Hg) at +1Gz were investigated in this paper for six test subjects. Various models were developed and tested to simulate these responses. The results show that a single-zero, two-pole, output-error model is suitable for characterizing the blood pressure responses to G-suit and Positive Pressure Breathing (PPB) pressures. A single-input model is used for the case of G-suit pressure with and without synchronized PPB, whereas a double-input model is used for the case of G-suit pressure with asynchronic PPB. The suitability of the models developed to high +Gz environment is investigated based on the data from a prior centrifuge test of one subject. Special dynamic indices are used to quantify the characteristics of the blood pressure responses. Significant variations in the dynamic indices of individual subjects and the same subject observed at different time instances are seen. These variations indicate that a fixed standard G-suit pressure schedule might not necessarily be capable of providing adequate Anti-G protection for all subjects and even for the same subject at different time instances. The models developed in this paper can be used in an adaptive feedback control system for real-time identification and update of subjects' Anti-G protection requirements. Consequently, the G-suit pressures can be adjusted based on these models to provide most adequate Anti-G protections and compensate the variations in subject's physiological state.
Author
Models; Pressure Breathing; Pressure Suits; Real Time Operation; Computerized Simulation; Gravitational Effects; Acceleration Stresses (Physiology); Aerospace Medicine; Physiological Responses

20000032409 Dayton Univ., OH USA
MODEL DERIVED TIMING REQUIREMENTS FOR GZ PROTECTION METHODS
Rogers, Dana B., Dayton Univ., USA; Models for Aircrew Safety Assessment: Uses, Limitations and Requirements; August 1999, pp. 22-1 - 22-6; In English; See also 20000032388; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

Studies of GLOC during Gz maneuvers highlight the need for further understanding of both orthostatic and transient behavior of blood pressure driven quantities in response to a variety of Gz profiles. Important in the analysis are duration, rates of change, direction and magnitude of transition and system memory (time at previous G level). The wide variety and number of profiles that need to be explored is intractable for human experimentation, indicating the need for functional models that provide a method for analyzing transient Gz equivalence under multiple profile conditions. The

model used for this study uses a normalized set of Gillingham's data that is analyzed in a log amplitude and log frequency plot. The model is designed by the method of asymptotes for use in aircraft simulators.
Derived from text
Acceleration Stresses (Physiology); Models; Human Factors Engineering; Flight Crews; Computerized Simulation; Acceleration Tolerance

20000032412 Air Force Research Lab., Noise and Vibration Branch, Wright-Patterson AFB, OH USA
THE DEVELOPMENT OF A LUMPED-PARAMETER MODEL FOR SIMULATING THE VIBRATION RESPONSE OF THE HUMAN BODY
Smith, S. D., Air Force Research Lab., USA; Models for Aircrew Safety Assessment: Uses, Limitations and Requirements; August 1999, pp. 25-1 - 25-11; In English; See also 20000032388; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

Seating systems provide a mechanism for minimizing the transmission of vehicle vibration to the occupant. Human vibration data has indicated that differences exist in the distribution of the mass, stiffness, and damping characteristics between the smaller female and larger male which may be important when designing seating systems. Mathematical models may provide a useful tool for the development and evaluation of seating systems for vibration mitigation. However, in order to be effective, these models must adequately simulate and predict the range of vibration response characteristics observed in the human body. A five degree-of-freedom (DOF) model was developed based on the dynamic response characteristics of major anatomical regions or structures in the human body. The model was recently modified to represent the legs as a two DOF system based on vibration response data collected in this laboratory. This paper summarizes the development, modification, and effectiveness of the five DOF model in simulating the differences between representative female and male vibration responses. The model is also evaluated on its ability to predict the effects of seat cushions on human body vibration response.
Author
Human Body; Vibration; Biodynamics; Human Factors Engineering; Mathematical Models; Computerized Simulation; Occupational Diseases; Health

20000032688 Air Force Research Lab., HECP, Wright-Patterson AFB, OH USA
PILOT-VEHICLE INTERFACE
Calhoun, G. L., Air Force Research Lab., USA; Human Consequences of Agile Aircraft; March 2000, pp. 5 - 1 - 5 - 20; In English; See also 20000032683; Copyright Waived; Avail: CASI; A03, Hardcopy

Agile aircraft introduce new requirements and performance standards for the pilot-vehicle interface. This lecture will address these ergonomic issues as they pertain to agile aircraft. Specifically, controls and displays will be discussed, followed by design issues relevant to intelligent interfaces. The concepts and technologies proposed as candidate solutions for creating pilot-vehicle synergy are, for the most part, untested at present. It is hoped that this lecture will provide the impetus for the research required to realize a pilot-vehicle interface that will enhance the operation of agile aircraft, new capabilities, it is the multitude of systems that constitute agile aircraft that make the pilots' information management task the primary challenge and key determinant of successful deployment. Crew station design with the goal of pilot-cockpit synergy has the potential to provide the flexibility to maximum mission effectiveness.
Author
Human Factors Engineering; Flight Characteristics; Aircraft Pilots; Flight Fatigue; Flight Control; Display Devices; Flight Stress (Biology); Human-Computer Interface

20000037836 Boeing Co., Mesa, AZ USA
TEST AND EVALUATION OF THE MAN-MACHINE INTERFACE BETWEEN THE APACHE LONGBOW(TM) AND AN UNMANNED AERIAL VEHICLE
Kraay, Anthony G., Boeing Co., USA; Pouliot, Michelle L., Boeing Co., USA; Wallace, William J., Boeing Co., USA; Advances in Vehicle Systems Concepts and Integration; April 2000, pp. B14-1 - B14-7; In English; See also 20000037804; Copyright Waived; Avail: CASI; A02, Hardcopy

The Boeing Company is studying a concept that involves teaming a manned rotorcraft, the Apache Longbow, with a unmanned air vehicle (UAV). During 1997 Boeing developed a preliminary man-machine interface between the Apache Longbow and an unmanned air vehicle. An early assessment of the man-machine interface in a virtual simulation environment was conducted. The study concentrated on the effects of crew workload during manned-unmanned teaming operations and acceptability of the design in terms of presentation of the data, functionality, and utility. A limited assessment of operational measures of effectiveness was also conducted. Subject pilots were satisfied with the man-machine interface, did not experience task overload and were able to perform UAV control tasks. Subjects did experience some difficulty with target acquisition and tracking, however. Initial data suggests that the potential exists to detect targets beyond the organic sensor range of current attack/reconnaissance rotorcraft without being exposed to threat detection.
Author
Pilotless Aircraft; Rotary Wing Aircraft; Man Machine Systems; Human-Computer Interface

20010002534 Defence Evaluation Research Agency, Centre for Human Sciences, Farnborough, UK
HUMAN BODY MODELING AS A HUMAN FACTORS ENGINEERING TOOL
Beagley, Nick, Defence Evaluation Research Agency, UK; The Capability of Virtual Reality to Meet Military Requirements; November 2000, pp. 12-1 - 12-7; In English; See also 20010002522; Copyright Waived; Avail: CASI; A02, Hardcopy

Computer based human body modeling provides a tool with which human factors issues can be assessed early in a system's design. By populating an interactive visualisation of a design with representative mannequins issues such as fit, reach and vision can be evaluated and design changes recommended at the concept stage. Body modeling tools are continually advancing, offering increasingly sophisticated dynamic representations of the human operator. For the influence of these tools to spread further, they must minimise the demands placed on their users. The user requires a consistent, stable tool which answers the traditional questions of human factors evaluation at an early point in the design cycle.
Author
Human Body; Body Measurement (Biology); Human Factors Engineering; Systems Engineering

20010016869 Hollandse Signaalapparaten N.V., Hengelo, Netherlands
CAN HUMAN PERFORMANCE BE ADDRESSED WITHIN THE CURRENT SAFETY ASSESSMENT PROCESS?
Boasson, Maarten; The Human Factor in System Reliability: Is Human Performance Predictable?; January 2001, pp. 1-1 - 1-3; In English; See also 20010016868; Copyright Waived; Avail: CASI; A01, Hardcopy

This document outlines the answer to the question: Can human performance be addressed within any safety assessment processes? Details are given on system boundaries, human performance, safety, and limits to our abilities.
CASI
Human Performance; Safety; Assessments

20010016870 York Univ., Dept. of Computer Science, UK
THEA: A TECHNIQUE FOR HUMAN ERROR ASSESSMENT EARLY IN DESIGN
Pocock, Steven, York Univ., UK; Wright, Peter, York Univ., UK; Harrison, Michael, York Univ., UK; The Human Factor in System Reliability: Is Human Performance Predictable?; January 2001, pp. 2-1 - 2-13; In English; See also 20010016868; Original contains color illustrations; Copyright Waived; Avail: CASI; A03, Hardcopy

Human activity constitutes a major source of vulnerability to the integrity of interactive systems. Wherever human actions are either inappropriate, incorrect, or erroneous, there will be implications for design. This is especially true in high risk endeavours such as commercial air and marine transportation, power production, medical care, and space flight. The aim should therefore always be to design an interactive system as resilient to human erroneous actions as possible, and to achieve this as early as possible in the design

phase. We present in this paper a formative error assessment technique contributing to the achievement of this goal, known as the Technique for Human Error Assessment (THEA). The method has been applied to several real-world case studies and has demonstrated its suitability in evaluating a design for its vulnerability to human interaction failures which may become problematic once the design becomes operational.
Author
Human Performance; Human Reactions; Risk; Error Analysis

20010016872 Vrije Univ., Vakgroep Psychonomie Provisorium, Amsterdam, Netherlands
EFFECTS OF PRACTICE AND MEMORY AIDING ON DECISION PERFORMANCE AND INFORMATION SEARCH IN COMMAND AND CONTROL
Roelofsma, Peter H. M. P., Vrije Univ., Netherlands; The Human Factor in System Reliability: Is Human Performance Predictable?; January 2001, pp. 5-1 - 5-20; In English; See also 20010016868; Original contains color illustrations; Copyright Waived; Avail: CASI; A03, Hardcopy

This study examines to what extent practice (learning by doing) and memory aiding (paper and pencil) affects human decision performance and information search in command and control. A management command control task which simulates a dynamic competitive environment was used for this purpose. In six practice sessions memory aiding was systematically varied. One hundred four subjects participated in the simulation task. Their success score, failure score, and decision speed score (number of decisions made per session) were measured as well as their information search profile. The results show that memory aiding led to a decrease of the number of decisions made and eventually resulted in a decrease in the overall success score. It led also to a decrease in the amount of information that subjects searched. Subjects used a satisfying decision making strategy, using little information, which proved however to be successful in the long run. Practice resulted in a slight but significant increase in the amount of information search. However, most information was searched after the decision as a means of justifying the decision. It is concluded that memory aiding makes subjects spend too much time in problem structuring, at least relative to the dynamics of a complex command and control environment. The results are discussed in terms of cognitive continuum theory.
Author
Decision Making; Human Performance; Information Retrieval; Memory

20010028483 State Univ. of New York, Dept. of Industrial Engineering, Buffalo, NY USA
HUMAN FACTORS IN AIRCRAFT INSPECTION
Drury, Colin G., State Univ. of New York, USA; Aging Aircraft Fleets: Structural and Other Subsystem Aspects; March 2001, pp. 7-1 - 7-11; In English; See also 20010028476; Copyright Waived; Avail: CASI; A03, Hardcopy

Inspection of both airframes and engines is a key activity in maintaining continuing airworthiness. Unless structural defects are detected at the appropriate time, structural failure may result. The reliability of the inspection system must be known in order to schedule safe inspection intervals. However, inspection reliability necessarily includes human inspector reliability so that knowledge of human inspection performance is vital to safety. This paper describes models of the major functions of the human inspector, and applies these within a framework of inspection reliability. From these models, and field experiments on inspectors a set of factors known to affect inspection reliability is derived. These can be used to define good practices necessary to continuously improve inspection performance.
Author
Inspection; Airframes; Aircraft Reliability; Human Factors Engineering; Structural Failure

20010028490 State Univ. of New York, Dept. of Industrial Engineering, Buffalo, NY USA
HUMAN FACTORS IN AIRCRAFT MAINTENANCE
Drury, Colin G., State Univ. of New York, USA; Aging Aircraft Fleets: Structural and Other Subsystem Aspects; March 2001, pp. 15-1 - 15-9; In English; See also 20010028476; Copyright Waived; Avail: CASI; A02, Hardcopy

Human error is cited as a major causal factor in most aviation mishaps, including the 15% - 20% that involve maintenance error. Errors can be described as active failures that lead directly to the incident, and latent failures whose presence provokes the active failure. Typical aviation maintenance errors are presented as examples and two approaches to human error reduction given: incident based and task analysis based. Each approach provides data on performance shaping factors, i.e. situation variables that affect the probability of error occurrences. Examples are given of interventions derived from analysis of incidents and from task analysis.
Author
Human Factors Engineering; Aircraft Maintenance; Error Analysis; Failure; Errors

20010032439 Ernst-Rodenwalt-Inst., Koblenz, Germany
SPECIAL RATIONS FOR LONG RANGE RECONNAISSANCE TROOPS
Restorff, W., Ernst-Rodenwalt-Inst., Germany; Diebold, K., Ernst-Rodenwalt-Inst., Germany; Brezina, T., Ernst-Rodenwalt-Inst., Germany; The Effect of Prolonged Military Activities in Man. Physiological and Biochemical Changes. Possible Means of Rapid Recuperation; March 2001, pp. 10-1 - 10-4; In English; See also 20010032429; Copyright Waived; Avail: CASI; A01, Hardcopy

In 1987 the Federal Armed Forces decided to develop or search for a light-weight high calorie field ration intended for the supply of soldiers on extended special missions outside of the supply area and solely dependent on themselves. Since they have to be provided with all provisions required for the duration of their mission, the field ration is reduced in volume and weight and.comprises various food items of high calorie density specially adapted to the operational conditions of long range reconnaissance troops, frogmen, armored reconnaissance units and paratroopers. The Federal Agency for Defence Technology and Procurement composed two different light-weight rations of high calorie density consisting of ready to eat 'energy bars' and dehydrated food to which hot water has to be added before consuming, which was specially adapted to the operational conditions of long range reconnaissance troops, armored reconnaisance troops, and SEALS. The Division for Exercise Physiology was asked to assist in evaluating possible medical or physiological risks during a planned 20 day field exercise during which only light-weight rations were to be eaten.
Author
Armed Forces; Dehydrated Food; Eating; Procurement; Rations

20010054773 Research and Technology Organization, Human Factors and Medicine Panel, Neuilly-sur-Seine, France
THE REQUIREMENTS FOR AN EMERGENCY BREATHING SYSTEM (EBS) IN OVER-WATER HELICOPTER AND FIXED WING AIRCRAFT OPERATIONS *[SPECIFICATION D'UN RESPIRATEUR DE SAUVETAGE POUR AERONEFS A VOILURE FIXE ET A VOILURE TOURNANTE EN MISSION DE SURVOL MARITIME]*
Brooks, Chris J., Survival Systems Ltd., Canada; Tipton, Mike J., Portsmouth Univ., UK; May 2001; 92p; In English; CD-ROM contains full text document in PDF format; Original contains color illustrations Report No.(s): RTO-AG-341; AC/323(HFM-054)TP/22; ISBN 92-837-1058-4; Copyright Waived; Avail: CASI; A05, Hardcopy; A01, Microfiche; C01, CD-ROM

This AGARDograph provides the latest worldwide statistics on survivability from a helicopter ditching. It concludes that the persistent 15% fatality rate is basically caused by drowning. The principal cause of drowning is due to inability to breath-hold long enough to make an escape. The provision of some form of Emergency Breathing System (EBS), whether a re-breather or compressed air unit, would extend the time underwater and hence improve survivability. The development of such units since the Second World War are described, and current available units are included to aid NATO and PfP Nations to review their choice. The importance of producing a course training package prior to the introduction of any new EBS into service is presented. Two examples are specifically cited. Finally, a summary is made of the current EBS situation as we enter into the 21st Century.
Author
Underwater Breathing Apparatus; Life Support Systems; Survival Equipment; Escape (Abandonment)

20010056302 Research and Technology Organization, Human Factors and Medicine Panel, Neuilly-sur-Seine, France
NATO GUIDELINES ON HUMAN ENGINEERING TESTING AND EVALUATION *FINAL REPORT [DIRECTIVES OTAN EN MATIERE D'ESSAIS ET D'EVALUATIONS ERGONOMIQUES]*
May 2001; 108p; In English; CD-ROM contains full text document in PDF format
Report No.(s): RTO-TR-021; AC/323(HFM-018)TP/19; ISBN 92-837-1068-1; Copyright Waived; Avail: CASI; C01, CD-ROM; A06, Hardcopy; A02, Microfiche

Testing and Evaluation (T&E) is an integral part of the system development process. Human Engineering T&E addresses the quality and effectiveness of the interface between the humans who participate as part of a human-machine system and the hardware and other non-human components. In the interest of supporting among NATO nations the co-development, co-production of systems, and shared use of T&E resources as a means of sharing more effective and less expensive systems, this document describes techniques and methods that are recommended for common use in NATO. The measurement categories addressed are: (1) Description of test participants; (2) Measurement of operator workload; (3) Human task performance measurement; (4) User opinion; and (5) Engineering measurement of hardware characteristics. It is recommended that the techniques and methods described be used to the maximum extent possible, and that the list be revised periodically to support currency and continued usefulness.
Author
Human Factors Engineering; Human Performance; Human-Computer Interface; Evaluation

20010056513 Research and Technology Organization, Human Factors and Medicine Panel, Neuilly-sur-Seine, France
HUMAN CONSEQUENCES OF AGILE AIRCRAFT *[FACTEURS HUMAINS LIES AU PILOTAGE DES AVIONS DE COMBAT TRES MANOEUVRANTS]*
May 2001; 186p; In English; 15-17 Apr. 1997, Istres AFB, France; 19-20 May 1997, Nellis AFB, NV, USA; 5-8 Oct. 1997, Linkoping, Sweden; 17-19 Apr. 1998, Manching, Germany; 14-16 Oct. 1998, Edwards AFB, CA, USA; 12-14 May 1999, Wright-Patterson AFB, OH, USA; See also 20010056514 through 20010056525; CD-ROM contains full text document in PDF format; Original contains color illustrations
Report No.(s): RTO-TR-015; AC/323(HFM-015)TP/15; ISBN 92-837-1065-7; Copyright Waived; Avail: CASI; C01, CD-ROM; A09, Hardcopy; A02, Microfiche

While historically agile flight was first seen as an issue of airframe agility with a consequent emphasis on acceleration issues, there has been an evolution in the understanding of agility. WG 27 adopted WG 19's recommendations that airframe agility is only one aspect of agility which when combined with weapons agility and systems agility results in operational agility. The experienced pilots that we interviewed saw a real operational need for agile aircraft. They consistently rated both high angle-of-attack/nose pointing and off-boresight missiles/helmet-mounted display/sight systems as very important capabilities. They denied physiologic problems related to acceleration or spatial disorientation, although their sorties to date have been with a clear sky, in active control. Experts predict an increase in both G-LOC and spatial disorientation mishaps in future agile aircraft. In particular, there are significant gaps in our understanding of the effects of multi-axis accelerations. With minimal constraints on angle-of-attack and expanded weapon launch envelopes, novel displays will be required that enable pilots to fly with references well beyond conventional fields-of-view. Intelligent interfaces, and automated subsystems will be required to help pilots cope with the tactical situation, while also maintaining situational awareness. Efficient controls are also needed to enable pilots to command and operate equipment quickly and accurately. The thrust-vectoring and post-stall operations should be fully integrated into the flight control system. Pilots still prefer controlling aircraft functions via HOTAS (hands-on-throttle-and-stick) although voice and gaze-based control may also be useful. Current pilot protection systems will be inadequate in an unconstrained flight envelope and during ejection. Both basic and applied research will be needed to ensure that the potential benefits of increased agility are realized.
Author
Aerodynamic Characteristics; Maneuverability; Thrust Vector Control; Pilots (Personnel); Flight Control; Human Factors Engineering; Highly Maneuverable Aircraft; Conferences

20010056514 Biodynamic Research Corp., San Antonio, TX USA
INTRODUCTION
Banks, R. D., Biodynamic Research Corp., USA; Lyons, T. J., Asian Office of Aerospace Research and Development, Japan; Firth, J., Queens Medical Centre, UK; Human Consequences of Agile Aircraft; May 2001, pp. 1-9; In English; See also 20010056513; Copyright Waived; Avail: CASI; A02, Hardcopy

Benjamin Gal-Or has been one of the leading proponents of high-agility propulsion. Many of his ideas, and those of his contemporary Wolfgang Herbst, are visionary, futuristic, and controversial. In a relatively short period of time, these men, and others, have influenced the direction of fighter aircraft design. 'High-agility' aircraft are now being tested and flown operationally. This new technology will offer new challenges, and threats, to human operators. Solving the inevitable human factors problems that will emerge will involve questioning established doctrine, and reaching for innovative and imaginative solutions. The 'inherent time-lag' referred to by Gal-Or could apply equally to the time-lag that now exists between the evolution of high-agility flight capability and current human protective/performance technology. There currently exists a technology gap, the precise nature of which is only partly understood. Typically, human factors are considered only after concept, design, and aircraft prototype development, and often after loss of life. Some human factors problems, identified years ago, have never been completely solved. Failure to identify the inevitably unique problems that will attend human exposure to the high-agility flight environment will unquestionably lead to needless loss of life and scarce resources. High-agility flight will challenge every aspect of human protection and performance. Many old engineering designs and assumptions will be challenged. During the narrow window of opportunity that now exists between concept, test, and widespread operational deployment of high-agility aircraft such as the F-22 and JSF, aggressive research aimed at exploring the problems and solutions will enhance the value of the these weapons, and prevent needless loss of life.
Author
Aircraft Design; Human Factors Engineering; Highly Maneuverable Aircraft

20010056515 Institut de Medicine Aerospatiale Armee, Bretigny sur Orge, France
'OPERATIONAL NEED' AND 'SITUATIONAL AWARENESS' SURVEY
Grau, J. Y., Institut de Medicine Aerospatiale Armee, France; Lyons, T. J., Asian Office of Aerospace Research and Development, Japan; Human Consequences of Agile Aircraft; May 2001, pp. 11-19; In English; See also 20010056513; Copyright Waived; Avail: CASI; A02, Hardcopy

Determining the human consequences on crews of flying agile aircraft is not an easy task, because of the lack of operational feedback regarding missions performed with these aircraft. A way to envisage potential human consequences is to transfer the experience acquired on agile aircraft prototypes and on last generation combat aircraft to the operational situations these future agile aircraft are expected to meet. To this end, the Working Group #27 carried out a survey with pilots of last generation combat aircraft flying in the Air Forces represented in the working group. In order to envisage the different fields of potential human consequences, the Working Group #27 led two actions between April 1997 and October 1998: first, interviews conducted with experienced military fighter pilots and test pilots concerning the operational need and consequences of agile aircraft flight on physiology and pilot-vehicle issues; second, questionnaire survey developed to address psychological consequences of agile aircraft flights and its consequences on situational awareness and mission performance.
Author
Highly Maneuverable Aircraft; Human Factors Engineering; Human Performance

20010056516 Office National d'Etudes et de Recherches Aerospatiales, Systems Control and Flight Dynamics Dept., Salon Air, France
AGILITY: DEFINITIONS BASIC CONCEPTS AND HISTORY
LeBlaye, Patrick, Office National d'Etudes et de Recherches Aerospatiales, France; Human Consequences of Agile Aircraft; May 2001, pp. 21-38; In English; See also 20010056513; Original contains color illustrations; Copyright Waived; Avail: CASI; A03, Hardcopy

The purpose of this presentation is to provide some engineering basis of the concept of agility. The definition of agility has evolved across recent aviation history, from the well known area of airframe agility to a global concept of operational agility. Some historical definitions are given and the underlying concepts are explained. The working group 27 has adopted the consensus definitions initially proposed by the working group 19 of the Flight Mechanics Panel of AGARD, in order to support its discussion on the Human consequences of aircraft agility. The concept of agility can be applied to each component of the combat system (airframe, systems, weapons). Agility factors specific to each component are briefly examined, and some orders of magnitude are given, concerning present and future weapon systems performances, which may have particular consequences on the human in flight. The concept of operational agility is introduced; this concept integrates the role of the human pilot. This paper is concluded with some perspectives for potential areas of preoccupation relative to human implications of the future combat scenarios and information environment.
Author
Highly Maneuverable Aircraft; Aeronautical Engineering; Pilot Performance

20010056519 Air Force Research Lab., Wright-Patterson AFB, OH USA
PILOT-VEHICLE INTERFACE
Calhoun, G., Air Force Research Lab., USA; LeBlaye, P., Office National d'Etudes et de Recherches Aerospatiales, France; Welsch, H., Institute of Aviation Medicine, Germany; Human Consequences of Agile Aircraft; May 2001, pp. 59-97; In English; See also 20010056513; Copyright Waived; Avail: CASI; A03, Hardcopy

The steady development and integration of advances in aerodynamics, flight control, propulsion, materials, equipment, structures, and avionics promise to make agile aircraft a reality. Through these developments, exciting new capabilities in agile airframes, agile weapons, and agile systems will be available to pilots. However, the ergonomic design of the pilot-vehicle interface (PVI) for agile aircraft poses a more difficult challenge, compared to designing earlier high performance aircraft. For instance, the high angular rates, accelerations, and onset rates of agile airframes place heavy demands on pilots and life support systems. If these fail, ejection from an unconstrained flight envelope makes additional demands on egress systems. With minimal constraints on angle-of-attack and expanded weapon launch envelopes, novel display formats will be required that enable pilots to fly with references well beyond conventional fields-of-view. Improvements in aircraft dynamics and weapons capabilities have also led to a dramatic increase in the tempo of the tactical situation. This, in turn, reduces the pilot's available processing and decision time. Decision aids and automated subsystems are required to help pilots cope with these increasing demands, while also maintaining situational awareness (SA). Recent advancements in sensor and off board information technology have resulted in an explosion in the complexity and sheer quantity of information that potentially can be displayed to the pilot. Efficient displays, utilizing these technologies, are needed to provide pilots with the 'right data, in the right place, at the right time.' Efficient controls are also needed to enable pilots to command and operate equipment quickly and accurately. In sum, agile aircraft, in terms of airframe, weapons, and systems, introduce new requirements and performance standards for crew station design.
Derived from text
Pilot Performance; Decision Making; Decision Support Systems; Human-Computer Interface

20010056523 Asian Office of Aerospace Research and Development, Tokyo, Japan
CONCLUSIONS
Lyons, T. J., Asian Office of Aerospace Research and Development, Japan; Human Consequences of Agile Aircraft; May 2001, pp. 131-136; In English; See also 20010056513; Copyright Waived; Avail: CASI; A02, Hardcopy

While historically the issue of agile flight was first seen as an issue of airframe agility with a consequent emphasis on acceleration issues, there has been an evolution in the understanding of agility. Working Group (WG) 27 adopted the recommendations from WG 19, that aircraft agility is only one aspect of agility which when combined with weapons agility and systems agility results in 'operational agility.' Increases in agility of each of these components will result in increased Global Agility which will result in an increased information flow being made available to the pilot. This increased information flow will need to be efficiently utilized in order to maximize operational agility and mission effectiveness.
Author
System Effectiveness; Highly Maneuverable Aircraft

20010056524 Ponomarenko (V.), Moscow, Russia
HIGH-SPEED FLIGHT AS A SYSTEM OF MEDICAL-PSYCHOLOGICAL SUPPORT OF DOMINATION IN THE AIR, APPENDIX B
Ponomarenko, V., Ponomarenko (V.), Russia; Human Consequences of Agile Aircraft; May 2001, pp. 141-148; In English; See also 20010056513; Copyright Waived; Avail: CASI; A02, Hardcopy

It is pilot's activity under unnatural environmental conditions which serves as an impetus for understanding the sources of man's essential strength, regularities of the ultimate sense of a pilot's needs in mastering the universe. Is this a source of spiritual strength? Here is a question for airspace medicine: Airspace medicine, as its name implies, deals with what takes place far beyond the horizon, as its object is not only the functioning of an organism under extreme biophysical conditions but the subject as a sky inhabitant as well. A pilot as a sky inhabitant exists in a different world of values. In particular, he perceives a high-speed flight, above all, as an instrument for achieving the main result, namely, superiority in dual situations. Speed is a maneuver, tactics which is transformed by intellect into a successful achievement of the final result. Th speed of the flight is always experienced as passion. These seemingly irrelevant speculations are directly related to the safety of high-speed flight. The point is that in a maneuvering air battle a pilot is not so much afraid of losing consciousness as his prestige, his professional ego. It is this purposefulness and not fear that draws him back to a zone of realized extended risk.
Derived from text
Pilot Performance; Psychological Factors; Risk

20010058955 Research and Technology Organization, Human Factors and Medicine Panel, Neuilly-sur-Seine, France
SOLDIER MOBILITY: INNOVATIONS IN LOAD CARRIAGE SYSTEM DESIGN AND EVALUATION *[LA MOBILITE DU COMBATTANT: INNOVATIONS DANS LA CONCEPTION ET L'EVALUATION DES GILETS D'INTERVENTION]*
Soldier Mobility : Innovations in Load Carriage System Design and Evaluation; May 2001; 280p; In English; 27-29 Jun. 2000, Kingston, Canada; See also 20010058956 through 20010058977; CD-ROM contains full text document in PDF format
Report No.(s): RTO-MP-056; AC/323(HFM-043)TP/28; ISBN 92-837-1062-2; Copyright Waived; Avail: CASI; C01, CD-ROM; A13, Hardcopy; A03, Microfiche

On 27-29 June 2000, NATO, Partners for Peace and Non-NATO nationals from 10 countries met in Kingston, Canada to discuss soldier mobility through innovations in load carriage system design and evaluation. Sponsored by the Human Factors and Medicine Panel (HFM) of the North Atlantic Treaty Organization's Research and Technology Organization, the specialist's meeting participants examined the current state of knowledge in load carriage, exchanged findings from recent research and development initiatives, explored what initiatives were needed to develop new concepts in design and evaluation and identified opportunities for collaboration. Specific sessions were held on the physiology, biomechanics and performance measures of load carriage, approaches and tools for assessment, development and validation of objective tests and their use in design solutions, mathematical modelling and the accuracy of pressure sensor measurement systems. There were two keynote addresses, twenty-five scientific papers, four workshops on future directions and tours of load carriage research facilities during the conference. The meeting unveiled many new findings, such as: possible energy transfers between body segments and

between the pack and the person; objective assessment technologies for better understanding and design of load carriage systems; an interest in mathematically modelling the pack-person interactions and their effects on the carrier; and a willingness to work together toward sharing resources, data and the development of an improved STANAG for personal load carriage.
Author
Biodynamics; Conferences; Human Factors Engineering; Human Performance; Weight (Mass)

20010058956 Aeromedical Inst., Soesterberg, Netherlands
PHYSIOLOGICAL STRAIN DURING LOAD CARRYING: EFFECTS OF MASS AND TYPE OF BACKPACK
Holewijn, Michael, Aeromedical Inst., Netherlands; Meeuwsen, Ted, Aeromedical Inst., Netherlands; Soldier Mobility : Innovations in Load Carriage System Design and Evaluation; May 2001, pp. 1-1 - 1-12; In English; See also 20010058955; Copyright Waived; Avail: CASI; A03, Hardcopy

The effects of mass (0, 5.4, 10.4 kg) and the type of support (on the shoulder or on waist) on physiological and mechanical strain indices of four young male subjects were quantified. While standing, oxygen uptake was not influenced by the type or mass of the backpack, and averaged 10% maximal oxygen uptake. The heart rate increased significantly by 9 beats per min while standing wearing a backpack. While walking (1.33 m/s) the mass significantly influenced both the heart rate and the oxygen uptake carried, but both types of strain remained below the tolerance limits for prolonged wear. Standing supporting a load did not significantly increase the electromyographic (EMG) signal of the trapezius shoulder muscle (pars descenders). While walking, load carrying significantly increased the EMG of the shoulder muscles. The pressure on the skin under the shoulder straps during load carrying on the shoulders was more than a factor of three times higher than the threshold value for skin and tissue irritation. Load transfer to the waist with a flexible frame reduced the pressures on the skin of the shoulder to far below the threshold value. On basis of these results it was concluded that even with relatively low loads the limiting factor was the pressure on the skin, if a waist belt did not relieve such pressure on the shoulders.
Author
Physiology; Shoulders; Walking; Weight (Mass); Stress (Physiology); Muscular Fatigue; Human Performance

20010058957 Army Research Inst. of Environmental Medicine, Military Performance Div., Natick, MA USA
CORRELATES OF LOAD CARRIAGE PERFORMANCE AMONG WOMEN
Pandorf, Clay E., Army Research Inst. of Environmental Medicine, USA; Harman, Everett A., Army Research Inst. of Environmental Medicine, USA; Frykman, Peter N., Army Research Inst. of Environmental Medicine, USA; Patton, John F., Army Research Inst. of Environmental Medicine, USA; Mello, Robert P., Army Research Inst. of Environmental Medicine, USA; Nindl, Bradley C., Army Research Inst. of Environmental Medicine, USA; Soldier Mobility : Innovations in Load Carriage System Design and Evaluation; May 2001, pp. 2-1 - 2-9; In English; See also 20010058955; Copyright Waived; Avail: CASI; A02, Hardcopy

To examine correlates of the speed at which female soldiers carrying loads could cover ground on foot, 12 volunteers (mean+/-SD: 25.316 years, 166+/-7 cm, 61.3+/-7 kg) were timed over 3.2 km while carrying loads of 14, 27, and 41 kg. Respective course times were 25.7+/-3, 30.7+/-4 and 36.9+/-5 min, which differed significantly ($p<0.05$) from each other. A correlation analysis with independent variables of body mass, bitrochanteric diameter, hip circumference, shoulder diameter, height, age, relative Maximal oxygen uptake (VO2(sub max)), (ml/kg/min), absolute VO2(sub max) (1/min), percent body fat, fat free mass, and self-reported scores on the Army fitness test (pushups, situps and 3.2 km run) revealed that absolute VO2(sub max) max and 3.2 kin run time were the best predictors of loaded 3.2 km run time for each load. Correlation coefficients for the 14, 27 and 41 kg load course times respectively were -0.64, -0.61 and -0.70 for absolute VO2(sub max) and 0.80, 0.67 and 0.75 for the 3.2 km run time. For the 14 and 27 kg loads there were no anthropometric measurements that correlated well with run time. However, with the 41 kg load, there were good relationships ($p<0.1$) between 3.2 km run time and body mass (r=-0.59), height (r=-0.55), hip circumference (r=-0.52) and fat free mass as determined from skin folds (r=-0.56). This suggests that larger subjects with greater muscle mass, for whom the 41 kg load represented a smaller percentage of their bodyweight, were able to carry the heaviest load faster than smaller, less muscular subjects.
Author
Anthropometry; Females; Muscles; Physical Exercise; Weight (Mass); Human Performance

20010058958 Centre de Recherches du Service de Sante des Armees, Unite de Bioenergetique, Clamart, France
A COMBINATION OF BIOMECHANICAL AND PHYSIOLOGICAL APPROACHES FOR DETERMINATION OF OPTIMAL LOAD DISTRIBUTION
Bigard, A. X., Centre de Recherches du Service de Sante des Armees, France; Soldier Mobility : Innovations in Load Carriage System Design and Evaluation; May 2001, pp. 3-1 - 3-7; In English; See also 20010058955; Copyright Waived; Avail: CASI; A02, Hardcopy

France is developing an integrated soldier ensemble that will improve soldier protection, survivability and sustainability. Improvement of the soldier's load carrying capacity remains an important step that will contribute to the maintenance of good health and protection against the side effects induced by soldier systems. A number of factors can influence the energy cost associated with locomotion. The aim of many studies has been to determine the level of oxygen uptake that can be maintained without physical fatigue. A myriad of kinematic and kinetic parameters may directly or indirectly influence the energy cost of locomotion, especially when subjects are walking with loaded backpacks. While the metabolic energy cost of human movement is easy to estimate by the global measure of total body oxygen consumption (VO2), a variety of computational techniques have been suggested as appropriate for the calculation of mechanical power. The changes in energy of the centre of mass (via ground reaction forces) have been frequently used to estimate the mechanical power of locomotion. One limitation of these measures is that they do not include the work done in moving the limbs and arms. This work, often termed 'internal work', is one essential component of total mechanical work associated with locomotion. Because measures of mechanical power which do not include contributions from all of the internal and external work done may provide misleading information, recent methods involving a segmental analysis have been suggested to determine the changes in the energy of individual body segments. Thus, measures of both oxygen consumption during walking and load carriage, and mechanical work are two essential steps in the assessment of the relationship of physiological energy expenditure to mechanical factors. Our approach to the study of human movement efficiency involves determination of the mechanical efficiency of human locomotion with backpack loads simultaneously with measurement of biochemical, cardiovascular, muscular and mechanical responses that occur during treadmill walking. In the framework of the development of the French soldier system, the first step of our program is to determine the optimal distribution and placement of the load by examining the changes in mechanical work, muscular activity and energy cost of walking on a treadmill.
Author
Biodynamics; Physiological Responses; Walking; Human Performance; Weight (Mass); Mass Distribution

20010058959 Dalhousie Univ., School of Health and Human Performance, Halifax, Nova Scotia Canada
THE EFFECT OF LOAD POSITION ON BIOMECHANICAL AND PHYSIOLOGICAL MEASURES DURING A SHORT DURATION MARCH
Johnson, R. C., Dalhousie Univ., Canada; Pelot, R. P., Dalhousie Univ., Canada; Doan, J. B., Queens Univ., Canada; Stevenson, J. M., Queens Univ., Canada; Soldier Mobility: Innovations in Load Carriage System Design and Evaluation; May 2001, pp. 4-1 - 4-6; In English; See also 20010058955; Copyright Waived; Avail: CASI; A02, Hardcopy

This project attempted to determine the physiological and biomechanical effects of varying the centre of gravity of a load in a backpack in a short duration activity. Experienced soldiers (n=22) carried a 36.0 kg modified US Army ALICE backpack on a treadmill at 5.6 km/h for 15 minutes at 0' elevation. The subjects carried the load in three locations in a backpack (a high, middle and low distribution) and employed a load carriage vest as an 'alternative'

distribution. This 'alternative' distribution balanced the load on the front and back of the subject. Oxygen consumption results showed no statistically significant difference between load locations (P = 0.621). Biomechanical analysis of the trunk lean and minimum included hip angles indicated significant differences between all 'alternative' comparisons as well as between the low and high load locations (P< 0.05). Maximum knee flexion angles were also shown to be significantly different between the low and alternate conditions. Cadence, stride length and displacement of the body Center of Gravity (COG) did not show significant differences between conditions. Subjective evaluation indicated a strong preference for the alternative load condition due to the overall increased mobility and decreased feeling of discomfort. Under the conditions tested in this study it was concluded that load location does not significantly affect oxygen consumption but had a large impact on the perception of each load trial. A longer duration activity that imposes a larger strain on the subjects would be required to confirm this oxygen cost finding. The effect that trunk lean and the flexion angles will have on fatigue and energy consumption in a long-term exercise scenario has not been determined but should be undertaken in future studies. The subjective impact on the subjects should be considered as highly important and should therefore have an impact on the future design of load carriage systems.
Author
Biodynamics; Center Of Gravity; Mobility; Physical Exercise; Physiological Effects; Position (Location); Exercise Physiology

20010058960 Army Research Inst. of Environmental Medicine, Natick, MA USA
LOAD-SPEED INTERACTION EFFECTS ON THE BIOMECHANICS OF BACKPACK LOAD CARRIAGE
Haran, Everett, Army Research Inst. of Environmental Medicine, USA; Han, Ki-Hoon, Army Research Inst. of Environmental Medicine, USA; Frykman, Peter, Army Research Inst. of Environmental Medicine, USA; Soldier Mobility: Innovations in Load Carriage System Design and Evaluation; May 2001, pp. 5-1 - 5-16; In English; See also 20010058955; Copyright Waived; Avail: CASI; A03, Hardcopy

We biomechanically examined how backpack load and walking speed interact in their effects. 16 males walked under all 12 combinations of 6, 20, 33, and 47 kg backpack loads and 1.17, 1.33, and 1.50 m/s walking speeds. Generally, the effects of load were consistent over the speeds, and the effects of speed were consistent over the loads. Ground reaction forces and impulses, joint forces, muscle torques, muscle electrical activity and back-pack acceleration increased when speed and/or load increased. likely increasing the probability of fatigue and injury. As load increased, percentage of stride in double-support and time of toe-off increased, and maximum hip angle decreased, likely improving stability and reducing stress on the musculoskeletal system. However, increases in walking speed tended to cancel these adaptations. At the lower speeds but not the highest one, stride frequency increased and stride time decreased when the load increased from 33 to 47 kg. Downward impulses for the major lower body joints increased with load carried, but decreased as walking speed increased. At the 1.33 m/s speed, but not at 1.50 m/s, a gait adaptation resulted in a less-than-expected impulse increase when the load increased from 33 kg to 47 kg. At the fastest walking speed, the volunteers could not further increase stride frequency to reduce stride length, increase stability, and reduce potential lower body stresses. Thus, it appears that soldiers should avoid, if possible, walking faster than 1.33 m/s (4.8 km/hr; 3.0 mi/hr) when carrying backpack loads approaching 47 kg (100 lb).
Author
Males; Muscular Function; Walking; Weight (Mass); Human Performance; Exercise Physiology; Physiological Effects; Physical Exercise

20010058961 Army Research Inst. of Environmental Medicine, Military Performance Div., Natick, MA USA
THE EFFECT OF LOAD CARRIAGE ON TRUNK COORDINATION DURING TREADMILL WALKING AT INCREASING WALKING SPEED
LaFiandra, Michael, Army Research Inst. of Environmental Medicine, USA; Obusek, John P., Army Research Inst. of Environmental Medicine, USA; Holt, Kenneth G., Boston Univ., USA; Wagenaar, Robert, Boston Univ., USA; Soldier Mobility: Innovations in Load Carriage System Design and Evaluation; May 2001, pp. 6-1 - 6-7; In English; See also 20010058955; Original contains color illustrations; Copyright Waived; Avail: CASI; A02, Hardcopy

The purpose of this experiment was to determine the effects of walking speed and wearing a backpack on trunk coordination and upper and lower body angular momentum. Twelve subjects (5 male, 7 female, mean age, yr: mean+/-SD = 26+/-7.1) walked on a treadmill at increasing speeds from 0.6 m/s to 1.6 m/s in 0.2 m/s increments. Subjects walked with a backpack (BP) containing 40% of their body mass and with no backpack (NBP). Peak pelvic and thoracic angular velocities were measured, and peak upper body and lower body angular momentum and the relative phase between the pelvis and thorax were calculated. A Repeated Measures ANOVA with two within-subject factors (load and speed) was used to compare the dependent variables. A significant main effect of BP condition was found in pelvic ($p < 0.000\ 1$) and thoracic ($p < 0.0001$) angular velocities, upper ($p < 0.0003$) and lower ($p < 0.0001$) body angular momentum, and relative phase ($p < 0.0014$). In addition, a significant main effect of walking speed was found in thoracic angular velocity ($p < 0.0001$), pelvic angular velocity ($p < 0.0001$), upper body angular momentum ($p < 0.0001$), lower body angular momentum ($p < 0.0001$), and relative phase ($p < 0.0001$). A significant interaction effect between speed and load was determined for thoracic angular velocity ($p < 0.0001$), upper body angular momentum ($p < 0.0006$), and relative phase ($p < 0.0001$). There were higher pelvic and thoracic angular velocities, and higher upper and lower body angular momentum in the NBP condition compared to the BP condition. In the NBP condition, relative phase between pelvic and thoracic rotation increased from 54 degrees at .6 m/s to 122 degrees at 1.6 m/s. In contrast, the increase in relative phase in the BP condition was less, from 48 degrees at .6 m/s to 78 degrees at 1.6 m/s. With the addition of the BP, the decrease in thoracic angular velocity observed was disproportionate to the increase in the moment of inertia of the upper body caused by the addition of the pack, resulting in lower upper body angular momentum compared to the NBP condition. The lower upper body angular momentum in the BP condition may have occurred as a means to reduce the muscular force required to rotate the thorax, and hence lowered the metabolic cost of the increased load.
Author
Angular Momentum; Angular Velocity; Walking; Physical Exercise; Exercise Physiology; Biodynamics; Weight (Mass)

20010058962 Army Natick Soldier Center, Supporting Science and Technology Directorate, Natick, MA USA
THE EFFECTS OF LOAD WEIGHT : A SUMMARY ANALYSIS OF MAXIMAL PERFORMANCE, PHYSIOLOGICAL, AND BIOMECHANICAL RESULTS FROM FOUR STUDIES OF LOAD-CARRIAGE SYSTEMS
Polcyn, Amy Fronduti, Army Natick Soldier Center, USA; Bensel, Carolyn K., Army Natick Soldier Center, USA; Harman, Everett A., Army Research Inst. of Environmental Medicine, USA; Obusek, John P., Army Research Inst. of Environmental Medicine, USA; Soldier Mobility: Innovations in Load Carriage System Design and Evaluation; May 2001, pp. 7-1 - 7-11; In English; See also 20010058955; Original contains color illustrations; Copyright Waived; Avail: CASI; A03, Hardcopy

Data from studies of standard and prototype load-carriage equipment were analyzed to determine the effects of the weight borne by male and female load carriers on time to traverse a 3.2 km course at self-paced, maximal speed and on energy expenditure and kinetic and kinematic variables during externally paced walking at 4.8 km/h. The equipment configurations included fighting, approach, and sustainment loads, with masses varying from 12 kg to 50 kg. It was found that course completion times and energy expenditure were directly related to the weight carried. The effects of load weight on the kinematic and kinetic variables were more complex. They included evidence of adaptations in walking gait that are likely to aid the load carrier in maintaining stability and in absorbing the increased forces associated with increased load on the body.
Author
Biodynamics; Walking; Human Performance; Physical Exercise; Exercise Physiology; Weight (Mass); Body Kinematics; Kinetics

20010058963 Army Research Inst. of Environmental Medicine, Natick, MA USA

CORRELATES OF OBSTACLE COURSE PERFORMANCE AMONG FEMALE SOLDIERS CARRYING TWO DIFFERENT LOADS

Frykman, P. N., Army Research Inst. of Environmental Medicine, USA; Harman, E. A., Army Research Inst. of Environmental Medicine, USA; Pandorf, C. E., Army Research Inst. of Environmental Medicine, USA; Soldier Mobility: Innovations in Load Carriage System Design and Evaluation; May 2001, pp. 9-1 - 9-9; In English; See also 20010058955; Copyright Waived; Avail: CASI; A02, Hardcopy

To examine correlates of obstacle course performance, 11 female volunteers (mean+/-SD: 25.3+/-5.5 yrs, 166+/-6.5 cm, 61.3+/-6.7 kg) negotiated an obstacle course (low hurdles, zigzag run, low crawl, overhead horizontal pipe, wall, and sprint) with a 14 kg fighting load and a 27 kg approach load. Predictive variables included Army physical fitness test (APFT: pushups, situps, and 3.2 km run) scores, treadmill VO2(sub max) and anthropometric variables. For the 14 kg load, pushups and situps correlated moderately (p<01) with time to negotiate the low crawl and pipe. With the 27 kg load the APFT score correlated moderately with zigzag and low crawl times, body height correlated (p<0.1) with hurdles and zigzag times, and VO2(sub max) correlated with zigzag and pipe performance. Only 55% of wall traversal attempts with the fighting load and 27% with the approach load were successful, and 80% of pipe traversal attempts with the fighting load and 30% with the approach load were successful. Because so many volunteers could not negotiate these stations, times for the segments were not included in the analysis of total course time. Pushups (r=-0.54, p<0 1) and situps (r=-0.62, p<0.1) best predicted course time with the 14 kg load, while the APFT score (r=-0.57, r<0.1) best predicted time with the 27 kg load. Aerobic fitness and muscular endurance play important roles in obstacle course performance. As measures of these abilities, the total APFT score and its pushup and situp sub-scores can serve as field expedient predictors of obstacle course performance.

Author

Females; Performance Prediction; Physical Exercise; Physical Fitness; Weight (Mass)

20010058964 New York Univ., Dept. of Physical Therapy, New York, NY USA

THE INFLUENCE OF LOAD CARRYING METHODS ON GAIT OF HEALTHY WOMEN

Ling, Wen, New York Univ., USA; Axen, Kenneth, New York Univ., USA; Houston, Vern, Veterans Administration, USA; Soldier Mobility: Innovations in Load Carriage System Design and Evaluation; May 2001, pp. 10-1 - 10-6; In English; See also 20010058955; Copyright Waived; Avail: CASI; A02, Hardcopy

Various load configurations on healthy men, but not women, have been examined. Women were found to have higher incidence of musculoskeletal injuries when carrying a heavy load during basic training. The purpose of this study was to examine the changes in gait patterns of healthy women while carrying a 10 Kg. load on the back, around the waist, and across one shoulder. The investigators further evaluated the influence of shoulder muscle strength on their gait with three load carrying configurations. Nine healthy women without existing orthopedic problems in the spine and legs were recruited for this study, ranging in ages from 22 to 32 years, with a mean of 25.2. Their height ranged from 148 to 179 centimeters, with a mean of 161.8. Their weight ranged from 45 to 74.1 kilograms, with a mean of 57.7. Fourteen reflective markers were placed on the subjects' trunk and legs. Two videocameras were used to film the subject walking along a 10 meter walkway. Each subject was first required to walk at her self-selected speed without any load to establish a baseline and then, in random order, walk with a 10-Kg. load on the back, around the waist, and diagonally across one shoulder. The videotape was analyzed using the Ariel Performance Analysis System. Angles of trunk, shoulder, hip, knee, and ankle were calculated. Torque output of subject's shoulder flexors, extensors, abductors, adductors, horizontal abductors, and horizontal adductors were measured on a Biodex II isokinetic dynamometer. Each subject was required to complete three sets of concentric contraction at 150 degrees/second. The total work for three contractions was normalized to each subject's weight. Analyses of variance with repeated measures were used to examine the influence of load carrying methods on gait. Multiple regression analyses were conducted to evaluate the influence of shoulder girdle muscle strength. Results: Subjects walked with significantly different trunk and shoulder angles (p<0.001) when walking with three load carrying configurations compared with the baseline and demonstrated the most rigid and flexed trunk when carrying the load on the back. Shoulder angles were significantly asymmetrical when carrying a load diagonally across one shoulder. There was no significant difference in hip, knee, and ankle angles. Shoulder girdle muscle strength strongly correlated with trunk and shoulder angles when carrying a load around the waist or on the back (r(exp 2)=0.855 to 0.989). Carrying a heavy load around the waist appeared to cause the least deviation from normal gait pattern for women. Women with strong shoulder muscles demonstrated less trunk and shoulder deviations when walking with a heavy load on the back.

Author

Females; Human Beings; Musculoskeletal System; Walking; Physical Exercise; Weight (Mass)

20010058965 Defence and Civil Inst. of Environmental Medicine, Toronto, Ontario Canada

DEVELOPMENT OF A SUITE OF OBJECTIVE BIOMECHANICAL MEASUREMENT TOOLS FOR PERSONAL LOAD CARRIAGE SYSTEM ASSESSMENT

Bossi, L. L., Defence and Civil Inst. of Environmental Medicine, Canada; Stevenson, J. M., Queens Univ., Canada; Bryant, J. T., Queens Univ., Canada; Pelot, R. P., Dalhousie Univ., Canada; Reid, S. A., Queens Univ., Canada; Morin, E. L., Queens Univ., Canada; Soldier Mobility: Innovations in Load Carriage System Design and Evaluation; May 2001, pp. 14-1 - 14-17; In English; See also 20010058955; Original contains color illustrations; Copyright Waived; Avail: CASI; A03, Hardcopy

The proper design of personal load carriage systems may be critical not only for soldier comfort, but also for soldier mobility and performance on the battlefield. Evaluation of soldier personal load carriage systems typically involves the conduct of human-based lab and field trials that can be both time-consuming and costly to conduct. Field testing usually requires multiple system prototypes of a given design iteration, with their development cost often limiting the number of design iterations tested. Human-based trials also rely on subjective opinion for system assessment. While the opinions of the ultimate users have face validity, and bias and error can be controlled in such trials, it is also desirable to have objective load carriage assessment methods and analysis tools that pen-nit rapid analysis, design iteration and evaluation. Canada has developed biomechanical assessment and analytical tools to supplement human-based load carriage system assessment methods. This suite of tools permits efficient objective evaluation of important biomechanical aspects of load-bearing webbing, vests, packs and their components, thus contributing to early system assessment and a rapid iterative design process. This paper will introduce each of the assessment and analytical tools, their rationale, the objective measures available and the recommended performance criteria for acceptable military load carriage systems. Separate papers in these proceedings will provide the details of validation and utility of the tools that have been developed by Canada.

Author

Biodynamics; Mobility; Weight (Mass); Supports

20010058966 Queens Univ., School of Physical and Health Education, Kingston, Ontario Canada

VALIDATION OF OBJECTIVE BASED MEASURES AND DEVELOPMENT OF A PERFORMANCE-BASED RANKING METHOD FOR LOAD CARRIAGE SYSTEMS

Bryant, J. T., Queens Univ., Canada; Doan, J. B., Queens Univ., Canada; Stevenson, J. M., Queens Univ., Canada; Pelot, R. P., Queens Univ., Canada; Reid, S. A., Queens Univ., Canada; Soldier Mobility: Innovations in Load Carriage System Design and Evaluation; May 2001, pp. 15-1 - 15-12; In English; See also 20010058955; Original contains color illustrations; Copyright Waived; Avail: CASI; A03, Hardcopy

Standardized objective measurements for the evaluation of load carriage include the development of a load carriage simulator, a stiffness tester, and a suspension system characteristics tester. In addition, human-based methods have been developed by which the performance of load carriage systems undergoing evaluation in standardized military activities can be assessed. The purpose of this paper is to summarize three studies that examine the correlation

between these objective and human-based measures. In the first study, face validation was undertaken by comparing the outcome of measurements made in pack-based systems using a simple biomechanical model. In the second study, a direct comparison of objective measures to human based measures in a cohort of military volunteers was undertaken. In a final study, a ranking method was explored as a way of characterizing military load carriage systems. Author

Biodynamics; Supports; Weight (Mass); Human Performance

20010058967 Army Natick Soldier Center, Ergonomics Team, Natick, MA USA

LESSONS LEARNED DURING THE DEVELOPMENT OF THE MODULAR LIGHTWEIGHT LOAD- CARRYING EQUIPMENT (MOLLE) SYSTEM

Sampson, James B., Army Natick Soldier Center, USA; Soldier Mobility: Innovations in Load Carriage System Design and Evaluation; May 2001, pp. 17-1 - 17-8; In English; See also 20010058955; Copyright Waived; Avail: CASI; A02, Hardcopy

The US Army conducted a comprehensive front-end analysis (FEA) which surveyed key users and identified critical issues and requirements for developing new load bearing equipment (LBE). From the FEA a detailed users' operational requirements document (ORD) was developed and from both the FEA and ORD the MOLLE emerged. The results of these efforts reveal several things about the methods used, as well as, issues and features of the system developed. This paper discusses the lessons learned about test methodology and features of LBEs found to work or not work for the dismounted combatant.

Author

Weight (Mass); Military Technology; Modularity

20010058968 Defence and Civil Inst. of Environmental Medicine, Operational Human Engineering Group, Toronto, Ontario Canada

HUMAN FACTORS ENGINEERING IN THE DEVELOPMENT OF A NEW LOAD CARRIAGE SYSTEM FOR THE CANADIAN FORCES

Bossi, L. L., Defence and Civil Inst. of Environmental Medicine, Canada; Tack, D. W., HumanSystems, Inc., Canada; Soldier Mobility: Innovations in Load Carriage System Design and Evaluation; May 2001, pp. 18A-1 - 18A-22; In English; See also 20010058955; Original contains color illustrations; Sponsored in part by CTS, DLR, and DSSPM; Copyright Waived; Avail: CASI; A03, Hardcopy

Human Factors Engineering (HFE) is contributing significantly to Canadian soldier protective clothing and personal equipment development and acquisition. From the conduct of user surveys and studies of baseline system performance, through the execution of controlled trials with representative users in the laboratory or the field, HFE is now impacting on virtually every stage of the Canadian soldier system development and acquisition cycle. This is especially the case for the development and acquisition of a new load carriage system for the Canadian Forces, under the auspices of the 'Clothe the Soldier' project. The integrated design team, led by DCIEM, involved experts in HFE, biomechanics and load carriage system design from the Department of National Defence, academia and industry. The team followed a user-centered iterative design and evaluation process to rapidly develop an integrated load carriage system that will meet the range of needs of Canadian soldiers. The system includes a tactical vest, a large rucksack and small pack system, each with removable and interchangeable storage pouches making it adaptable or configurable according to mission, environment, and individual needs. The paper will present an overview of the Human Factors systems design approach used to identify and validate user requirements, and will highlight some of the many lab and field evaluations and analyses used to make design and procurement decisions.

Author

Defense Industry; Human Factors Engineering; Product Development

20010058969 Defence Clothing and Textiles Agency, R and T Group, Colchester, UK

MATERIAL CHOICES FOR GOOD LOAD CARRIAGE DESIGN

Davies, Gareth, Defence Clothing and Textiles Agency, UK; Soldier Mobility: Innovations in Load Carriage System Design and Evaluation; May 2001, pp. 18B-1 - 18B-3; In English; See also 20010058955; Copyright Waived; Avail: CASI; A01, Hardcopy

The paper discusses the selection of fabrics, webbing, tapes, sewing threads and the issues that surround their choice in the military scenario. How infrared signature is achieved on synthetic materials, so that service personnel are hidden from night sights, is explained. A weldable material has been identified in the UK offering the opportunity to produce waterproof rucksacks. The choice of interface materials to the body is discussed and the new favoured double needle bar spacer fabric with its advantages on heat stress and load distribution capabilities is compared to the established plastic foams. The selection of buckles and the way to improve their robustness is shown. The age-old argument of internal frame versus external frame is debated.

Author

Fabrics; Military Technology; Tensile Strength

20010058970 Queens Univ., School of Physical and Health Education, Kingston, Ontario Canada

BIOMECHANICAL ASSESSMENT RUCKSACK SHOULDER STRAP ATTACHMENT LOCATION: EFFECT ON LOAD DISTRIBUTION TO THE TORSO

Reid, S. A., Queens Univ., Canada; Bryant, J. T., Queens Univ., Canada; Stevenson, J . M., Queens Univ., Canada; Doan, J. B., Queens Univ., Canada; Soldier Mobility: Innovations in Load Carriage System Design and Evaluation; May 2001, pp. 20-1 - 20-8; In English; See also 20010058955; Original contains color illustrations Contract(s)/Grant(s): W7711-7-7412/001/SRV; Copyright Waived; Avail: CASI; A02, Hardcopy

The objective of this study was to conduct biomechanical testing of pack component options to determine the optimal location for the lower attachment of the shoulder strap for the Clothe the Soldier (CTS) Integrated Patrol Pack and Rucksack. A model of a 50th percentile male torso has been split transversely at T12/L1 and instrumented with two six degree of freedom load cells. The shoulder area of the manikin was instrumented with Fscan(tm) sensors to record the contact pressure distribution in the axilla (armpit) and anterior of the shoulder under the shoulder strap. A 25 kg fixed payload was used for all test configurations. Waist belt, load lifter and shoulder strap tensions were constant during testing. Output variables were reaction forces at T12/L1, waist belt lifting force, average, and peak contact pressures about the shoulder. These were examined as a function of the attachment point location and as a function of the angle the shoulder strap made with respect to the body long axis. Strap angles above 30 degrees resulted in peak axilla contact pressures ranging from 35 to 64 kPa. At strap angles less than 24 degrees, anterior shoulder peak pressures of > 32 kPa were recorded. These two effects determined the upper and lower bounds of an optimal range of 24 to 30 degrees with respect to the vertical axis of the body. These results cannot be extrapolated to other attachment locations that were not tested and pertain only to the type of strap tested.

Author

Biodynamics; Position (Location); Weight (Mass); Mass Distribution; Straps; Human Performance

20010058971 Queens Univ., Ergonomics Research Group, Kingston, Ontario Canada

BIOMECHANICAL ASSESSMENT OF LATERAL STIFFNESS ELEMENTS IN THE SUSPENSION SYSTEM OF A RUCKSACK

Reid, S. A., Queens Univ., Canada; Whiteside, R. A., Queens Univ., Canada; Soldier Mobility: Innovations in Load Carriage System Design and Evaluation; May 2001, pp. 19-1 - 19-6; In English; See also 20010058955; Original contains color illustrations

Contract(s)/Grant(s): W7711-8-7461/001/SRV; Copyright Waived; Avail: CASI; A02, Hardcopy

The purpose of this study was to examine the change in load distribution characteristics associated with adding lateral stiffness elements (rods) to a rucksack. A manikin was instrumented to allow determination of the load applied to the shoulders and upper torso independent of the load applied to the hips and lower trunk. Position and mass of the payload (25 kg) was fixed at the centre of the volume of the rucksack and held constant during all testing. Results showed that this active stiffness element shifted 10% of the vertical load from the upper torso to the pelvic region with no adverse affect on other factors known to limit load carriage capacity. Lumbar shear load remained unchanged between the rod and no-rod conditions for all combinations of shoulder strap and waist belt tension. The lateral

rods also provided a greater extensor moment about the medio-lateral axis at the L3-L4 level.
Author
Biodynamics; Shoulders; Straps; Torso; Weight (Mass); Bioengineering

20010058972 Queens Univ., School of Physical and Health Education, Kingston, Ontario Canada
BIOMECHANICAL ASSESSMENT OF THE CANADIAN INTEGRATED LOAD CARRIAGE SYSTEM USING OBJECTIVE ASSESSMENT MEASURES
Stevenson, Joan M., Queens Univ., Canada; Reid, Susan A., Queens Univ., Canada; Bryant, J. Tim, Queens Univ., Canada; Pelot, Ron P., Dalhousie Univ., Canada; Morin, Evelyn L., Queens Univ., Canada; Soldier Mobility: Innovations in Load Carriage System Design and Evaluation; May 2001, pp. 21-1 - 21-12; In English; See also 20010058955; Original contains color illustrations; Copyright Waived; Avail: CASI; A03, Hardcopy

The purpose of this study was to provide an overview of contributions by biomechanical testing to the design of the final Canadian Clothe the Soldier (CTS) load carriage (LC) system. The Load Carriage Simulator and Compliance tester were used during design of the CTS system for evaluation of: three fragmentation vests, seven Tactical Vests and three iterations of the rucksack. Test data were compared to a data pool of previously tested systems. Results indicated that the objective measures helped the design team by: (1) understanding the consequences of various design changes; (2) predicting soldiers' responses to design changes in pressure, force and relative motion; (3) comparing this system objectively to other systems; and (4) providing information quickly so that ideas could be incorporated into the next design iteration. It was concluded that objective assessments added valuable information not easily interpreted from human trials. However, objective assessments cannot replace human trials for feedback on functionality and features.
Author
Biodynamics; Weight (Mass); Evaluation

20010058973 Loughborough Univ. of Technology, Dept. of Human Sciences, UK
MILITARY LOAD CARRIAGE: A NOVEL METHOD OF INTERFACE PRESSURE ANALYSIS
Martin, Jennifer, Loughborough Univ. of Technology, UK; Hooper, Robin, Loughborough Univ. of Technology, UK; Soldier Mobility: Innovations in Load Carriage System Design and Evaluation; May 2001, pp. 22-1 - 22-8; In English; See also 20010058955; Copyright Waived; Avail: CASI; A02, Hardcopy

In the current military climate there is a constant need to strike a balance between the increasing amount of equipment carried by the modern soldier and the need to optimise performance and health. In co-operation with the Defence Clothing and Textile Agency, load carriage equipment has been developed making use of novel interface materials. These are used to distribute interface contact areas more extensively yet maintain air space next to the body surface. The purpose is to minimise peak pressure zones and reduce discomfort and pain so as to optimise performance and reduce the opportunity for injury. The paper will present novel methods for analysing interface pressures measured during load carriage on a treadmill and will consider the efficacy of this brief, evaluative technique.
Author
Weight (Mass); Equipment Specifications; Human Performance

20010058975 Queens Univ., School of Physical and Health Education, Kingston, Ontario Canada
CALIBRATION ISSUES OF TEKSCAN SYSTEMS FOR HUMAN PRESSURE ASSESSMENT
Morin, E. L., Queens Univ., Canada; Bryant, J. T., Queens Univ., Canada; Reid, S. A., Queens Univ., Canada; Whiteside, B., Queens Univ., Canada; Soldier Mobility: Innovations in Load Carriage System Design and Evaluation; May 2001, pp. 24-1 - 24-7; In English; See also 20010058955; Original contains color illustrations; Copyright Waived; Avail: CASI; A02, Hardcopy

The Tekscan pressure sensor system has been designed for relatively easy measurement of contact pressures between two opposing surfaces. However, several factors are known to affect Tekscan sensor output. This paper reports on two pilot studies which were done to investigate the effects of contact surface compliance and changes in the system hardware on Tekscan sensor output. In the first study, linear calibration curves were calculated for a single Tekscan sensor array placed on surfaces of varying compliance. The slopes of the curves and variability in both the slopes and intercepts were found to be affected by surface compliance. In the second study, absolute percentage differences in the raw output data bits between a series of Tekscan sensor-cuff combinations were calculated. These differences ranged from 5-32%. The results of these studies indicate that careful attention must be paid to system set-up and calibration when using the Tekscan pressure sensor system to measure contact pressures.
Author
Calibrating; Pressure Measurement; Pressure Sensors; Variability

20010058976 Dalhousie Univ., Dept. of Industrial Engineering, Halifax, Nova Scotia Canada
A STATIC BIOMECHANICAL LOAD CARRIAGE MODEL
Pelot, R. P., Dalhousie Univ., Canada; Rigby, A., Queens Univ., Canada; Stevenson, J. M., Queens Univ., Canada; Bryant, J. T., Queens Univ., Canada; Soldier Mobility: Innovations in Load Carriage System Design and Evaluation; May 2001, pp. 25-1 - 25-12; In English; See also 20010058955; Sponsored in part by Defence R&D, Canada; Copyright Waived; Avail: CASI; A03, Hardcopy

A two-dimensional biomechanical model of a back-pack has been developed which incorporates the primary forces at the shoulder and waistbelt contact points. The model had been validated using instrumented manikins in laboratory experiments. The computer-based formulation allows the user to specify parameters for certain pack features, such as pack mass and volume, and it predicts the resulting contact forces on the bearer. By treating some parameters as decision variables, such as the location of attachment of the shoulder straps to the pack, the model can be used as an optimization tool to achieve a specified objective, such as minimizing the total forces on the bearer. A base case analysis and some variants illustrate this type of analysis. For the example provided, it is not possible to find a feasible solution within the prescribed shoulder-to-waist load ratio. By freeing up other variables, several alternative solutions are presented. This model can be used to easily examine trade-offs in certain pack design decisions.
Author
Biodynamics; Position (Location); Two Dimensional Models; Computerized Simulation; Weight (Mass)

20010058977 Salford Univ., School of Aeronautical and Mechanical Engineering, UK
IDENTIFYING AND MODELLING THE DYNAMIC BEHAVIOUR OF LOAD CARRIAGE SYSTEMS
Gretton, Michelle, Salford Univ., UK; Howard, David, Salford Univ., UK; Soldier Mobility: Innovations in Load Carriage System Design and Evaluation; May 2001, pp. 27-1 - 27-5; In English; See also 20010058955; Copyright Waived; Avail: CASI; A01, Hardcopy

This paper describes a UK MOD funded research project that aims to identify mathematical models for the dynamic behaviour of backpack suspensions. A test-rig is described which can be used to collect the dynamic data required, and the processing of the data is briefly discussed. The resulting pack suspension models can be combined with a human locomotion model, and used to study the effects of design changes that alter pack dynamics.
Author
Dynamic Characteristics; Locomotion; Mathematical Models; Weight (Mass)

20010066252 Research and Technology Organization, Human Factors and Medicine Panel, Neuilly-sur-Seine, France
THE IMPACT OF NATO/MULTINATIONAL MILITARY MISSIONS ON HEALTH CARE MANAGEMENT *[L'IMPACT DES MISSIONS OTAN/MILITAIRES INTERNATIONALES SUR LA GESTION DES SOINS DE SANTE]*
The Impact of NATO/Multinational Military Missions on Health Care Management; May 2001; 140p; In English; 4-6 Sep. 2000, Kiev, Ukraine; See also 20010066253 through 20010066273; CD-ROM contains full text document in PDF format; Original contains color illustrations
Report No.(s): RTO-MP-068; AC/323(HFM-051)TP/35; ISBN 92-

837-1059-2; Copyright Waived; Avail: CASI; C01, CD-ROM; A07, Hardcopy; A02, Microfiche

The proceedings include the Technical Evaluation Report, two key-note addresses, and solicited papers of the Specialists' meeting sponsored by the NATO Human Factors and Medicine panel and held at the 'Ukrainsky Dim' in Kiev, Ukraine, 4-6 September 2000. Recent major events across the world and at national levels have radically altered the global picture and have reshaped the NATO strategy from one aimed at resolving international conflict to one predominantly aimed at missions other than way (peacekeeping, humanitarian, disaster relief, etc.). Most of these missions are performed by multinational forces, which requires the cooperation of all military services including the medical support systems. The new objectives require radical changes in the organizational structure, management, and supply of national and allied military health systems. The purpose of this Specialists' Meeting was to exchange information and experience on Health Service Support (HSS) of multinational troops, to review the development of interoperable forms of multinational HSS in the field, to examine the lessons learned during actual operational deployment of multinational medical facilities, and to discuss the interplay between multinational, alliance/NGO, and civil/military operations in coping with disasters which require alliance or EAPC assistance.

Author

Medical Services; Health; North Atlantic Treaty Organization (NATO); International Cooperation; Standardization; Emergencies

20010066253 Ukranian Armed Forces, Military Medical Service, Kiev, Ukraine

MEDICAL SUPPORT OF ARMED FORCES OF UKRAINE: NEW VISION OF ORGANIZATIONAL STRUCTURE AND MANAGEMENT

Bily, V. Y., Ukranian Armed Forces, Ukraine; The Impact of NATO/Multinational Military Missions on Health Care Management; May 2001, pp. 1-1 - 1-5; In English; See also 20010066252; Copyright Waived; Avail: CASI; A01, Hardcopy

In recent years, the contribution of the human factor (personnel combat strength) to the fighting readiness of combat troops has increased considerably. On the one hand, the use of weapons with highly destructive characteristics may not only cause losses in manpower on a significantly higher scale, but these losses also have different characteristics (large numbers of multiple injuries, in addition to combat stress and fatigue). On the other hand, the armed forces of the civilized nations consist of military specialists managing modern military technologies. As is well known, the expenses of training a modern high quality military pilot training costs several million dollars, which is comparable with the cost of a jet-fighter. Therefore, the health and professional sustainability of military experts has obtained strategic importance. The purpose of the present report, which can be important for international medical community, is to describe the problems the Ukraine Armed Forces are currently facing in the area of military medical support. We have developed a concept for a new system of military-medical service, which is capable of providing modern quality standards of medical care. The concept aims at establishing a military-medical service which will include and combine three managerial infrastructures (curative-prophylactic, hygiene-epidemiological, and military-medical supply) and two systems (training of military-medical personnel and research).

Derived from text

Medical Services; Health; Armed Forces (Foreign); Management Systems

20010066254 Supreme Headquarters Allied Powers Europe, Logistics Div., Casteau, Belgium

NATO MEDICAL SUPPORT TO CRISIS RESPONSE OPERATIONS: A STRATEGIC VIEW

Klein, Leo, Supreme Headquarters Allied Powers Europe, Belgium; Kasper, Martin, Supreme Headquarters Allied Powers Europe, Belgium; The Impact of NATO/Multinational Military Missions on Health Care Management; May 2001, pp. 2-1 - 2-6; In English; See also 20010066252; Original contains color illustrations; Copyright Waived; Avail: CASI; A02, Hardcopy

The paper will present the Strategic Command Europe's view on multinational medical operations including current developments and the way ahead.

Author

Medical Services; International Cooperation

20010066255 German Air Force, First Air Div., Karlsruhe, Germany

FLEXIBILITY IS THE KEY TO AIRPOWER, MEDICAL POWER IS THE KEY TO OPERATIONS SUCCESS: LESSONS LEARNED FROM FLYING OPERATIONS OVER THE BALKANS

Jertz, Walter, German Air Force, Germany; The Impact of NATO/Multinational Military Missions on Health Care Management; May 2001, pp. 3-1 - 3-6; In English; See also 20010066252; Copyright Waived; Avail: CASI; A02, Hardcopy

This paper presents a brief overview of the European situation as described during the Summit Meeting of the Head of States in Washington, April 1999. The requirements for adequate Health Care Management from a military operational standpoint will be reviewed. The preparation and training, the situation in combat operations as well as after action care for airmen will be described, along with a discussion of lessons learned from recent military operations with special emphasis on the German view.

Author

Health; Medical Services; Military Operations; Requirements

20010066256 Ukrainian Armed Forces, Research Inst. of Military Medicine, Kiev, Ukraine

RATIONAL DISTRIBUTION AND USE OF MILITARY-MEDICAL RESOURCES

Vovkodav, Nikolay N., Ukrainian Armed Forces, Ukraine; Varus, Vassily, Ukrainian Armed Forces, Ukraine; The Impact of NATO/Multinational Military Missions on Health Care Management; May 2001, pp. 4-1 - 4-3; In English; See also 20010066252; Copyright Waived; Avail: CASI; A01, Hardcopy

The support of resources, including assessment of needs, the structure of the acquisition system, and the distribution and utilization of medical goods are among the most urgent problems of the military health care in Ukraine. The often ineffective performance of the military-medical service is due to the rigid, inflexible health resources system. A second negative factor is the irrational distribution of the limited resources, particular of the funds for the treatment of patients. The discrepancies can be explained by the high disease incident rates among military personnel. A third negative factor is the inadequate system of military-medical system financing, which does not allow the commanders to spend money on measures promoting the health of personnel. The paper describes the scope and essence of the current reform of distribution system and of the use of medical resources in the Ukraine Armed Forces. We will try to answer the following questions: (1) How can the leadership of the military-medical service develop strategies for a more rational distribution and utilization of military-medical resources? (2) What role do the managerial bodies of the military-medical system play in undertaking the reform of the health resource system?

Derived from text

Health; Medical Services; Resource Allocation; Financial Management

20010066257 Supreme Headquarters Allied Powers Europe, Logistics Div., Casteau, Belgium

PRE-DEPLOYMENT MEDICAL READINESS PREPARATION

Kasper, Martin, Supreme Headquarters Allied Powers Europe, Belgium; Klein, Leo, Supreme Headquarters Allied Powers Europe, Belgium; The Impact of NATO/Multinational Military Missions on Health Care Management; May 2001, pp. 5-1 - 5-4; In English; See also 20010066252; Copyright Waived; Avail: CASI; A01, Hardcopy

With emphasis on medical readiness preparation for the deployment of forces to a NATO/Multinational Military Mission, this paper will cover the following topics: (1) NATO Medical Support Principles and Policies; (2) Medical Operational Principles; (3) Allied Joint Medical Support Doctrine; (4) Crucial Aspects of the Most Likely Types of Current and Future Operations (Medical); (5) Force Protection, Medical Force Protection and Medical Force Protection Assessment; (6) Life-Cycle Medical Surveillance for Operational Deployment; and (7) Pre-Deployment Medical Readiness Preparation and Baseline Assessment.

Author

Policies; Medical Services; Preparation; Military Operations

20010066258 Ministry of Defence, Main Military Clinical Hospital, Kiev, Ukraine
SYSTEM OF PRIMARY HEALTH CARE IN KIEV MILITARY-MEDICAL CENTER
Bojchack, M. P., Ministry of Defence, Ukraine; Holyk, L. A., Ministry of Defence, Ukraine; The Impact of NATO/Multinational Military Missions on Health Care Management; May 2001, pp. 6-1 - 6-6; In English; See also 20010066252; Original contains color illustrations; Copyright Waived; Avail: CASI; A02, Hardcopy

The strategy of the World Health Organization (WHO) concerning the reorientation of health service to the primary medical care (PMC) is accepted by the majority of the states of the world. There are strong methodical, financial, and economical arguments for this. Taking into account the urgency and the importance of this problem, the Ministers of Health of many nations have accepted the Lublin Charter in 1996, which recommends that all health care systems develop and improve the PMC. The specific features of the health care system reform in Ukraine, the status of its financing, the process of decentralization and the transition to a market economy, all also emphasize the need to give a high priority to PMC. The main purpose and tasks of the reform of PMC are: (1) the gradual improvement of the health status of the population by the introduction of preventive measures, by early diagnosis of diseases, and by improving health care access and quality; (2) to distribute health care in an equitable manner across primary, secondary, and tertiary levels; (3) the rationalization of all types of public health services; (4) to reduce the costs of medical care by restricting specialized medical care to cases that really need it; and (5) to reduce the number of hospital admissions and to expand the network of day-care and medical aid stations. In this way, we will open the possibilities for the population as a whole to employ medical services, we will increase the patient's opportunities to choose a doctor, and we will increase the responsibility of the physician for the health status of his patients.
Derived from text
Medical Services; Priorities; Public Health; Management Systems

20010066261 Supreme Headquarters Allied Powers Europe, Logistics Div., Casteau, Belgium
DEPLOYMENT PHASE MEDICAL READINESS SUPPORT
Kasper, Martin, Supreme Headquarters Allied Powers Europe, Belgium; Klein, Leo, Supreme Headquarters Allied Powers Europe, Belgium; The Impact of NATO/Multinational Military Missions on Health Care Management; May 2001, pp. 9-1 - 9-4; In English; See also 20010066252; Copyright Waived; Avail: CASI; A01, Hardcopy

This paper on 'Deployment Phase Medical Readiness Support' will complete the information on medical readiness preparation requirements for the deployment of force to a NATO/Multinational Medical Mission.
Author
Deployment; Medical Services; Preparation; Requirements

20010066263 Ukrainian Armed Forces, Research Inst. of Military Medicine, Irpen, Ukraine
UNIFIED PRINCIPLES, REQUIREMENTS AND STANDARDS OF ARMED FORCES MEDICAL SUPPORT
Sokhin, Alexander, Ukrainian Armed Forces, Ukraine; The Impact of NATO/Multinational Military Missions on Health Care Management; May 2001, pp. 11-1 - 11-8; In English; See also 20010066252; Copyright Waived; Avail: CASI; A02, Hardcopy

Successful completion of any military mission requires a proper organization of the health service support (HSS) of the troops. The principal document serving as a guide for military and military-medical commanders, planning staff and physicians, is the Military-Medical Doctrine (Doctrine). There are national (multiservice), allied (NATO) and combined (NATO and PfP) Doctrines. Allied and combined Doctrines are designed to provide the necessary level of unification and standardization allowing to carry out joint medical services tasks more effectively and at low cost. On the other hand, they should take the special nature of national systems of medical services into account. Conceptions of allied or partner Doctrines must be presented in such manner that national differences in the Armed Forces medical support of participating countries will not trouble their interaction and cooperation. This paper focuses on the conceptual approach to the development of the Doctrine for Ukraine, and on differences and similarities with Doctrines of NATO and other countries. It will be emphasized that it is a common task for military commanders and the medical service, to ensure high standards of professional health as a crucial component of the combat strength of military personnel. Therefore, it is necessary to clearly determine the responsibilities and actions that are necessary in order to protect and preserve the health and life of military personnel.
Author
Health; Medical Services; Standardization

20010066265 Ukrainian Military-Medical Academy, Kiev, Ukraine
SYSTEM OF TRAINING AND CERTIFICATION OF MILITARY-MEDICAL PERSONNEL IN UKRAINE ARMED FORCES
Pasko, Vladimyr V., Ukrainian Military-Medical Academy, Ukraine; The Impact of NATO/Multinational Military Missions on Health Care Management; May 2001, pp. 13-1 - 13-4; In English; See also 20010066252; Copyright Waived; Avail: CASI; A01, Hardcopy

When Ukraine was proclaimed as an independent State, a national system for military-medical education was established. In the early nineties, the conceptual approaches and the structural model for the military-medical personnel training was developed. The tasks, organization, and principles of functioning of the Ukrainian Military-Medical Academy (UMMA) were determined and approved. By that time, there were 34 military educational institutions dislocated in Ukraine, but none of these was engaged in the training of military physicians, or in research in military medicine. All institutions working in these areas were historically situated in the Russian Federation. In 1992, initial legislative measures were taken by the government of Ukraine relating to the foundation of the UMMA. First of all, the training of military-medical specialists was recognized as one of the basic tasks of the National medical university. Then, the Government took the important decision to establish the Military Medical Department (MMD) as a part of this University. Undergraduate training, postgraduate training and specialization of military physicians and provisors meeting the State standards were set as the paramount tasks for the MMD. A no less important objective was the postgraduate training of military-medical managers and administrators of the Ministry of Defense, of specialists of civil health institutions working in the field of the State defense and security as well as of the medical corps of the Ministry of Emergency Situations. An essential part of the MMD's activities referred to the organization and implementation of fundamental and applied research in the field of military medicine. The first students were admitted to the MMD in 1993. Next, the Ukraine Military Medical Academy was founded on the base of the MMD as an independent training, research, methodical and information center of military-medical service. The present organization structure of the UMMA is shown.
Derived from text
Education; Medical Personnel; Medical Services; Personnel Development; Management Systems

20010066266 National Medical Univ., NILC, Kiev, Ukraine
PARTNERSHIP IN UKRAINE MINISTRY OF HEALTH AND ACADEMY OF MEDICAL SCIENCES SCIENTIFIC DIRECTION OF 'AEROSPACE MEDICINE'
Yatsenko, Valentine, National Medical Univ., Ukraine; The Impact of NATO/Multinational Military Missions on Health Care Management; May 2001, pp. 14-1 - 14-4; In English; See also 20010066252; Copyright Waived; Avail: CASI; A01, Hardcopy

The scientific direction of 'Aerospace Medicine' was generated in 1996 under the Ministry of Health (MOH) and the Academy of Medical Sciences (AMS) of Ukraine with the purpose: To link up the scientific potential of the MOH and the AMS of Ukraine for the solution of fundamental and applied problems of aviation and space medicine; To coordinate the partner relationships with establishments of a National Academy of Sciences, National Space Agency, Ministry of Defense of Ukraine and other departments; To advance international cooperation. To realize these objectives, seven scientific commissions have been set up, which cover the following topics: (1) Space Ecology; (2) Space Biotechnology; (3) Space Radiation Medicine; (4) Space Pharmacology and Toxicology; (5) Space Biomedicine; (6) Telemedicine; and (7) Aerospace Medicine.
Derived from text
Health; Medical Science; Aerospace Medicine; International Cooperation

20010066268 North Atlantic Treaty Organization, International Military Staff, Brussels, Belgium
INTERNATIONAL MILITARY MEDICAL STANDARDIZATION: STATUS AND PROSPECTS
Lam, David M., North Atlantic Treaty Organization, Belgium; The Impact of NATO/Multinational Military Missions on Health Care Management; May 2001, pp. 16-1 - 16-9; In English; See also 20010066252; Copyright Waived; Avail: CASI; A02, Hardcopy

The purpose of this paper is to discuss medical standardization within the international military arena. I will present the driving factors, procedures, and an overview of medical standardization within NATO of importance to PFP nations.
Author
Standardization; Medical Services

20010066270 Ukrainian Inst. of Public Health, Kiev, Ukraine
THE ROLE OF THE BRANCH UNIFIED STANDARDS OF MEDICAL TECHNOLOGIES IN UKRAINIAN PUBLIC HEALTH SYSTEM
Ponomarenko, V. M., Ukrainian Inst. of Public Health, Ukraine; Nahorna, A. M., Ukrainian Inst. of Public Health, Ukraine; Stepanenko, A. V., Ukrainian Inst. of Public Health, Ukraine; The Impact of NATO/Multinational Military Missions on Health Care Management; May 2001, pp. 18-1 - 18-3; In English; See also 20010066252; Copyright Waived; Avail: CASI; A01, Hardcopy

The history of development of medical standards in Ukraine started from the late of 1980s when on the wave of economic innovations, a number of local medical facilities standards have been produced. Their practical use, however, led to obtain not only positive but also negative experience such as a lack of uniform criteria, scientific and methodological substitutions of standards creation did not allow to carry out of the comparative evaluation of medical facilities activity and to undertake analysis of medical and economic effectiveness of standards use. The technological standards had various levels to guarantee the medical care quality providing by comparable medical facilities.
Derived from text
Public Health; Standards; Medical Services

20010066271 North Atlantic Treaty Organization, International Military Staff, Brussels, Belgium
MEDICAL EVACUATION, HISTORY AND DEVELOPMENT: THE FUTURE IN THE MULTINATIONAL ENVIRONMENT
Lam, David M., North Atlantic Treaty Organization, Belgium; The Impact of NATO/Multinational Military Missions on Health Care Management; May 2001, pp. 19-1 - 19-7; In English; See also 20010066252; Copyright Waived; Avail: CASI; A02, Hardcopy

This paper will present a brief overview of the history of casualty evacuation from the battlefield. The development of this essential part of military medical services will be reviewed, with particular emphasis upon the development of air evacuation. The future of casualty evacuation in the multinational environment of the new strategic situation will be discussed, along with NATO efforts to standardize various aspects of this modality of patient care.
Author
Casualties; Evacuating (Transportation); Medical Services

20010066272 Institute of Aviation Medicine, Germany
QUALIFIED AEROMEDICAL EVACUATION IN THE EXTENDED TASK SPECTRUM OF NATIONAL AND INTERNATIONAL MILITARY MISSIONS
Roedig, Erich, Institute of Aviation Medicine, Germany; The Impact of NATO/Multinational Military Missions on Health Care Management; May 2001, pp. 20-1 - 20-9; In English; See also 20010066252; Original contains color illustrations; Copyright Waived; Avail: CASI; A02, Hardcopy

The history of aeromedical evacuation (AE) is short and closely associated with the beginning of manned aviation. Its origins are credited to the Dutch medical officer De Mooy who, in about 1910, was the first to conceptualize the air transport of wounded patients and to describe the interaction of road, rail, and air transport. Air transport of wounded patients in hot-air balloons, frequently mentioned in the context of the Franco-Prussian War, however, must be considered a military anecdote as there is no historical evidence for it. First documented evidence for the routine employment of aircraft for the transport of wounded patients exists for the First World War when France established an aircraft ambulance organization. During the Spanish Civil War (1936 - 1938), the air transport of wounded patients to Germany was conducted on a larger scale, JU-52 type aircraft were equipped with ten stretchers. In addition, there were seats for up to eight soldiers. Medical oxygen was available and administered during the crossing of the Alps. By time of the Second Word War, organized air transport of wounded patients had been established in the military. The US-Army Air Corps for instance had evacuated 1.25 million patients by aircraft and with limited in-flight care (flight nurses) by 1945. While approximately 4% of the wounded were dead by the time they arrived for the first emergency surgical treatment during the Second World War, this percentage could be reduced to 1% during the Vietnam War when the introduction of helicopters for air rescue missions was brought to bear on a large scale. The operational need for a qualified AE system can also be inferred from the example of operation Desert Storm where approximately 30,000 allied soldiers were evacuated from the operational theater for reasons of health. During the KFOR/SFOR mission, the German Air Force evacuated 3o2 soldiers in 1999 by air, of which 25 patients were under critical conditions. During the UN Interfet mission in East Timor in 47 missions 230 soldiers and civilians were evacuated from East Timor to Darwin/Australia, of which 25 patients needed intensive care.
Author
Air Transportation; Evacuating (Transportation); Medical Services; Rescue Operations

20010066273 Akademiya Nauk URSR, Radiation Medicine Research Center, Kiev, Ukraine
EXPERIENCE IN ORGANIZATION OF URGENT MEDICAL CARE IN LARGE-SCALE ACCIDENT CONDITIONS AT NUCLEAR POWER STATIONS
Bebeshko, V., Akademiya Nauk URSR, Ukraine; The Impact of NATO/Multinational Military Missions on Health Care Management; May 2001, pp. 21-1- 21-3; In English; See also 20010066252; Copyright Waived; Avail: CASI; A01, Hardcopy

I would like to say that previous experience makes it possible not to repeat the same mistakes as well as optimize a complex of preventive and accident relief measures for minimizing possible damage. The further development of the urgent medical care service in radiation accident situations within united national disaster medicine service will minimize both the risk of an emergency at nuclear power stations and manpower and financial expenditures of public health authorities and institutions. The Chernobyl experience has shown, that early planning, proper organization and permanent preparedness of each branch of the urgent medical service in radiation accident situations will make its work well-coordinated and effective both in so called quiet periods and in emergency situations.
Author
Medical Services; Public Health; Emergencies

20010076801 Kings Coll., Dept. of Human Physiology and Aerospace Medicine, London, UK
PRESENT AND FUTURE COMPROMISES IN ALTITUDE PROTECTION IN COMBAT AIRCRAFT
Ernsting, John, Kings Coll., UK; Operational Medical Issues in Hypo- and Hyperbaric Conditions; June 2001, pp. KN1-1 - KN1-12; In English; See also 20010076799; Copyright Waived; Avail: CASI; A03, Hardcopy

The crews of high performance combat aircraft operating at high altitude are protected against the effects of exposure to high altitude by two methods viz pressurization of the cabin and raising the concentration of oxygen in the gas delivered by the oxygen system to the respiratory tract. The historical development of the current compromises between cabin pressurization and increasing the concentration of oxygen in the inspired gas is reviewed. The physiological requirements with respect to the prevention of hypoxia, decompression sickness, and otitic and sinus barotrauma are considered. The criteria for avoiding lung damage and hypoxia on rapid decompression are discussed. The changes required to the present specification for the cabin pressurization schedule of high altitude fighter aircraft associated with the increase in the operational ceiling above 50,000 feet and the agility of future fighter aircraft are considered. It is proposed that the maximum cabin pressure differential should be increased at altitudes above 40,000-45,000 feet to 6.0-6.7 lb/sq in. The relative simple fixed cabin pressurisation control systems currently employed should be replaced by variable differ-

ential pressure control, so that the optimum compromise can be made depending upon the nature and duration of the sortie.
Author
Differential Pressure; Gas Composition; Cabin Atmospheres; Human Factors Engineering; Physiological Factors

20010076840 German Federal Armed Forces Central Hospital, Abt. Anaesthesiologie und Intensivmedizin, Koblenz, Germany
CHANGES OF VENTILATOR GENERATED VOLUME AND PRESSURE UNDER SIMULATED CABIN PRESSURE PROFILES OF MILITARY AIRCRAFT C160 TRANSALL
Lang, M., German Federal Armed Forces Central Hospital, Germany; Operational Medical Issues in Hypo- and Hyperbaric Conditions; June 2001, pp. 42-1 - 42-6; In English; See also 20010076799; Copyright Waived; Avail: CASI; A02, Hardcopy

Pulmonary traumata and special intensive care therapies often lead to a respirator treatment. After stabilization of the patient vital functions in the medical installations of the operation area the respirator-treatment has to be continued during the air-transport for repatriation. Patient and ventilation equipment are exposed to certain influences caused by the air-transport. Originally respirators are built for the use on the ground (air-pressure 1013 mbar) with only slight changes (+/- 20 mbar) in air-pressure. In military Medevac-airplanes there are significant and quick changes (de- and increases) of the pressure cabin in cruising altitude and in tactical flight maneuvers. Aim of this study was to examine the influence of cabin pressure on important parameters of ventilation using different transport ventilators. Simulating cabin-pressure conditions, differences in the applied tidal volume and PEEP to a preset value were to be determined. The results of this study may help to develop guidelines to reduce the risk of the treatment of ventilated patients during air-transport.
Author
Pressure Distribution; Pressurized Cabins; Altitude Simulation

20010076846 Laboratoire de Medecine Aerospatiale, Bretigny-sur-Orge, France
EVALUATION OF SMOKE-FIGHTING PROTECTIVE EQUIPMENT FOR TECHNICAL NAVIGATIONAL PERSONNEL
[EVALUATION D'EQUIPEMENTS DE PROTECTION ANTI-FUMEES POUR LE PERSONNEL NAVIGANT TECHNIQUE]
Loncle, Monique, Laboratoire de Medecine Aerospatiale, France; Maugey, Bernard, Laboratoire de Medecine Aerospatiale, France; Clere, Jean Michel, Laboratoire de Medecine Aerospatiale, France; Bardel, Michel, Intertechnique S.A., France; Operational Medical Issues in Hypo- and Hyperbaric Conditions; June 2001, pp. 49-1 - 49-8; In French; See also 20010076799; Original contains color illustrations; Translated into English by SCITRAN, Inc.; Copyright Waived; Avail: CASI; A02, Hardcopy

In the case of toxic emanations such as smoke fumes released by an onboard fire, the crews of transport airplanes have available equipment that offers protection against this kind of accidental pollution; this includes quickly attachable regulator masks. These masks provide respiratory protection in case of a depressurization and also smoke-fighting protection. These masks are very frequently combined with glasses for smoke protection of the eyes.
Author
Protection; Masks

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COMPUTER OPERATIONS AND HARDWARE

20000032674 Defence Clothing and Textiles Agency, Science and Technology Div., Colchester, UK
THE DEVELOPMENT OF AN IMAGE MANIPULATION FACILITY FOR THE ASSESSMENT OF CCD
Houlbrook, A. W., Defence Clothing and Textiles Agency, UK; Search and Target Acquisition; March 2000, pp. 24-1 - 24-6; In English; See also 20000032651; Copyright Waived; Avail: CASI; A02, Hardcopy

The assessment of CCD systems using photosimulation is the tried and tested alternative to performing live observer trials. The greater control over photosimulations allows an increased level of confidence in the results of any comparisons. It also requires less time in the field for a smaller number of personnel. The next step along this route would be a method that required no time in the field. Virtual reality systems, however, do not yet produce the level of realism required. An alternative, perhaps, is to place targets generated by VR software into a scene recorded photographically. Such a system would digitize a slide of a background scene in a controlled manner and allow the realistic implantation of an artificially created target. Reproduction would be achieved using a calibrated film printer. The majority of the reprinted scene would remain identical to the original slide. The methods used to enable the calibration of the equipment used, and the process of comparing information from digital rgb and Lab colour spaces are discussed in this paper. This image manipulation facility has the potential to bypass the field trial phase of CCD assessment. It could be used to assess CCD more thoroughly by using a variety of background scenes or the same scene at different times of the year. Targets created from CAD models could be assessed. It could be used to determine the effectiveness of potential CCD measures in areas which are not readily accessible. Overall, this system adds a new level of flexibility and completeness to photosimulation.
Author
Image Processing; Imagery; Charge Coupled Devices; Photographs; Simulation; Color

20010012849 Air Force Research Lab., Rome, NY USA
AN EMBEDDED FUSION PROCESSOR
Rooks, John, Air Force Research Lab., USA; Space-Based Observation Technology; October 2000, pp. 51-1 - 51-5; In English; See also 20010012824; Copyright Waived; Avail: CASI; A02, Hardcopy

This paper describes an embedded High Performance Computer (HPC) designed to perform the sensor data fusion for the Discriminating Interceptor Technology Program (DITP). The HPC's electrical and physical architecture will be reviewed. The processor's architecture, FPASP5, evolved from years of Ballistic Missile Defense Organization (BMDO), and US Air Force research into wafer scale packaging and power efficient programmable signal processors for space-based applications. The processors, memory, and interface bare chips are packaged in Multichip Modules (MCMs). Our current version is designated MCM3. These MCMs can be stacked in thin layers before being inserted into the chassis level interconnect scheme. The chassis interconnect leverages a BMDO and Air Force Research Laboratory (AFRL) funded technology called Highly Integrated Packaging and Processing (HIPP). HIPP allows MCMs and two by two inch Printed Circuit Boards (PCBs) to be stacked together and interconnected with printed flexible flaps and a micro backplane. The combination of these techniques allows us to meet the strict constraints of space-based surveillance and interceptor applications. The following description starts with the processors followed by their interface chip and communication protocols. Then continues with the MCM and chassis level packaging. Finally the Fusion Processor's (FP) integration with other components and its software environment are reviewed.
Derived from text
Embedded Computer Systems; Multisensor Fusion; Imaging Techniques; Signal Processing; Signal Analyzers

20010047047 North Carolina State Univ., Raleigh, NC USA
THE RABI QUANTUM COMPUTER
Krutar, Rudolph A., North Carolina State Univ., USA; New Information Processing Techniques for Military Systems; April 2001, pp. 5-1 - 5-7; In English; See also 20010047042; Original contains color illustrations; Copyright Waived; Avail: CASI; A02, Hardcopy

Thomas Carlysle once wrote: 'Our main business is not to see what lies dimly at a distance, but to do what lies clearly at hand.' Totally ignoring that advice, I set about to examine how a quantum computer might eventually be exploited. (A quantum computer uses strange but real effects in Quantum Mechanics to explore many possibilities at the same time with the same hardware.) There are currently just four known quantum computer algorithms. The possibilities are staggering, but are not likely to be realized by attending only to what lies clearly at hand. Yes, we might be able to factor large numbers, search databases in fewer steps, evaluate simple global properties of arbitrary predicates, and simulate quantum systems. But we might also be able to factor complicated problems, search databases of large images and sounds, evaluate interesting properties of complicated functions, and simulate sound and weather systems. No one currently has any idea how to do anything that complicated on a quantum computer. The research community

therefore needs to focus on what has to be done to liberate the imaginations of students everywhere, so they can rework the foundations of their fields to exploit the exponential potential of quantum computers.
Author
Quantum Computers; Quantum Computation; Quantum Mechanics

20010082344 Naval Air Systems Command, Patuxent River, MD USA
AVOIDING OBSOLESCENCE WITH A LOW COST SCALABLE FAULT-TOLERANT COMPUTER ARCHITECTURE
Schaff, Josef, Naval Air Systems Command, USA; Strategies to Mitigate Obsolescence in Defense Systems Using Commercial Components; June 2001, pp. 20-1 - 20-6; In English; See also 20010082326; Copyright Waived; Avail: CASI; A02, Hardcopy

This new computer architecture can use anything from COTS (Commercial Off-The-Shelf) microcontrollers to the latest high-end processors. It is a distributed fault-tolerant architecture that is dynamically reconfigurable in the event of device failures, and is fully programmable in conventional high level languages. By using a simple two-level hierarchy with redundant control processors that configure the I/O (Input/Output) processor arrangement, even the failure of several processors will have no effect on data. An example is given of a realtime data acquisition system with a total cost for a 16 channel device with mixed sync/async and proprietary baud rates, of less than $500 in parts. This example system can be reconfigured to any arrangement of 16 or less serial interfaces. The architecture is flexible and can be expanded into two levels: status, health and monitoring; and clustered I/O and processing. Additional expansion to a third level would add adaptive learning aspects. Each processor can be dynamically removed or replaced, and is designed to run a minimal amount of processor-specific software about 1-2 kilobytes of code, which allows each new type of processor added to be configured to respond as a generic processor/CPU (Central Processing Unit). This facilitates the addition of new processors with a minimal amount of development. Present software may need to be modified to take full advantage of this architecture, although by using currently available distributed processor operating systems, most of the modifications can be avoided. The layout of the architecture allows both obsolete and state-of-the-art processors to work together, and transparent replacement of obsolete processors with newer ones. Some current software design methodologies can be applied to configuring the hardware architecture, such as CORBA - The architecture lends easily to Object Request Brokers - e.g., cluster CPU replacements can be specified by using Interface Definition Language-type description of CPU functionality, making it CORBA-like from a hardware perspective. Further development and acceptance of this architecture can lead to significant cost savings and mitigate obsolescence in future computer design.
Author
Architecture (Computers); Fault Tolerance; Software Engineering

20020016340 Laval Univ., Computer Sciences Dept., Sainte-Foye, Quebec Canada
TOWARDS A COMPARISON APPROACH OF ARCHITECTURES FOR INTEROPERABLE ENVIRONMENTS
Elkadhi, Abdelhamid, Laval Univ., Canada; Moulin, Bernard, Laval Univ., Canada; Maamar, Zakaria, Zayed Univ., United Arab Emirates; Information Management Challenges in Achieving Coalition Interoperability; December 2001, pp. 13-1 - 13-10; In English; See also 20020016329; Original contains color illustrations; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

In this paper we propose an approach to compare different architectures for interoperable environments. We present four different architectures: three of them use stationary agents and well-known negotiation organizations (use of a broker agent, use of the contract net protocol), the fourth one uses mobile agents and a meeting infrastructure. We propose a comparison function based on three main factors (message type, message size and risk). We also present the approach that is used to compare the architectures considering various scenarios which influence the interactions between the different agents involved in the negotiation process supported by the various architectures.
Author
Architecture (Computers); Interoperability; Protocol (Computers); Computer Programs

20020016344 Military Univ. of Technology, Warsaw, Poland
THE ROLE OF NATO C3 INTEROPERABILITY TESTING INFRASTRUCTURE TO ESTABLISH THE POLISH INTEROPERABILITY ARCHITECTURE
Amanowicz, M., Military Univ. of Technology, Poland; Gajewski, P., Military Univ. of Technology, Poland; Lubkowski, P., Military Univ. of Technology, Poland; Lysek, K., Military Univ. of Technology, Poland; Information Management Challenges in Achieving Coalition Interoperability; December 2001, pp. 17-1 - 17-11; In English; See also 20020016329; Original contains color illustrations; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

The need to improve interoperability at all levels of Consultation, Command and Control (C3) support, including areas from political consultation to tactical battlefield operations, remains the most important question for NATO (North Atlantic Treaty Organization). This is a main statement of NATO Policy for C3 Interoperability (NC3IP) that provides nations, NATO Military Authorities and other NATO bodies that will support their efforts to enhance C3 interoperability and achieve standardization objectives according to the NATO Interoperability Framework (NIF). In order to achieve and to maintain C3 interoperability the concept for NATO Interoperability Environment Testing Infrastructure (NIETI) was developed. The scope of NIETI is to support the life cycle testing of NATO Interoperability Environment (NIE) elements and operational interoperability within NATO and with Allied systems, including Partnership for Peace (PfP) nations by collecting, analyzing and managing interoperability data and making tests and demonstrations to provide specific interoperability information. According to this all nations are working out their interoperability requirements and making tests, which are able to confirm this requirements. The Polish interoperability requirements derive from NC3IP and NIETI. In this paper the authors describe the NIETI process that includes gathering, managing and analyzing data. They also present its impact on the development of the Polish Communications and Information Systems (CIS) interoperability testing infrastructure which was established in the Communications Systems Institute (CSI) of the Military University of Technology (MUT). In the paper authors briefly describe some experiments, which were performed in collaboration with NATO C3 Agency.
Author
Interoperability; Command And Control; North Atlantic Treaty Organization (NATO); Communication Networks; Information Systems

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COMPUTER PROGRAMMING AND SOFTWARE

19990040716 British Aerospace Aircraft Group, Military Aircraft and Aerostructures, Preston, UK
AN AUTOMATED METHOD OF ANALYSING STORE TRAJECTORY SIMULATIONS
Akroyd, G., British Aerospace Aircraft Group, UK; Aircraft Weapon System Compatibility and Integration; April 1999, pp. 2-1 - 2-11; In English; See also 19990040714; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

The use of 6 degree of freedom numerical methods for the simulation of store separation from combat aircraft is now widespread throughout the world. The simulations are usually validated against a limited set of flight trials and then the numerical models used to assess the store separation behaviour throughout the proposed release or jettison envelope. This method has the advantage that many tolerance conditions and 'what if' scenarios such as failure conditions can be studied safely and cost effectively. The simulations generally produce text output and graph plots of results for each case and often a trajectory 'picture' showing the store motion relative to the parent aircraft. Release cases are often time consuming to set up and even more time consuming to assess, especially as many tabulations or trajectory plots/graphical results have to be considered. At British Aerospace Military Aircraft, a simulation tool has been developed that allows models of high fidelity and accuracy to be created using a range of simulation techniques. The models can be created and executed using a graphical user interface and trajectories visualised in a 3D animation. An overview of the toolset known as STARS will be given in this paper. However, the real strength of the STARS system is the ability to run all the required tolerance cases in a batch mode with a range of post

processing tools for automated analysis of the results. It is this ability that is the main focus of this paper.
Author
Computerized Simulation; External Store Separation; Trajectory Analysis; Systems Simulation; Dynamic Models; Applications Programs (Computers); Subroutine Libraries (Computers)

19990092809 Office National d'Etudes et de Recherches Aerospatiales, Paris, France
CONTEXTUAL INFORMATION AND MULTISENSOR DATA FUSION FOR BATTLEFIELD APPLICATIONS
Bastiere, A., Office National d'Etudes et de Recherches Aerospatiales, France; Chalmeton, V., Thomson-CSF, France; Nimier, V., Office National d'Etudes et de Recherches Aerospatiales, France; Sensor Data Fusion and Integration of the Human Element; February 1999, pp. 6-1 - 6-10; In English; See also 19990092805; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

We propose in this article several multisensor tracking algorithms for battlefield application. Generally, the context is never taken into account in the multisensor systems. Moreover, it can have an influence on the performance of the sensors. Contexts can be for example hidden zones, jamming or meteorological conditions. The main interest of the presented research is to describe a multisensor tracking method which takes context into account and to use it for battlefield applications. By analysing the context, the relative confidence in the sensors is taken into account in the tracking algorithm. A ponderation coefficient is defined which represents a very simple way to handle and a very flexible tool to modulate the relative confidence of sensors depending on their own characteristics, their environment and those of the observed targets. This method avoids the possibility that the measurements of no reliable sensors disturbing the results of the global fusion. The objective is to have a robust system which always conserves the target track. In the last section of this article, we present results of numerical simulations based on realistic battlefield scenarios in which a ground target moves behind hidden zones. The proposed algorithm is compared with a classical tracking algorithm. This parallel emphasizes performance of the suggested method.
Author
Algorithms; Multisensor Fusion; Terrain Analysis; Combat; Simulation; Monte Carlo Method

19990092810 Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Inst. of Flight Guidance, Brunswick, Germany
IMAGE DATA FUSION FOR FUTURE ENHANCED VISION SYSTEMS
Doehler, H.-U., Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; Hecker, P., Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; Rodloff, R., Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; Sensor Data Fusion and Integration of the Human Element; February 1999, pp. 8-1 - 8-12; In English; See also 19990092805; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

New imaging sensors and high performance computer graphics systems have a great impact on the design of the human machine interface of novel cockpit systems. The improvement of aircraft safety and operational qualities under adverse weather can be achieved by so-called enhanced vision systems, which consist in principle of a combination of sensor- and synthetic vision. The following contribution describes the enhanced vision concept which has been developed at the Institute of Flight Guidance of the German Aerospace Center (DLR). Benefits of competing imaging sensors are compared, results of recently conducted field tests are shown and first concepts for a fusion of radar and synthetic images are presented.
Author
Enhanced Vision; Imaging Techniques; Multisensor Fusion; Radar Imagery; Multisensor Applications; Remote Sensing

19990092811 Turkish Navy, Dept. of Software Research and Technology, Turkey
A DISTRIBUTED SYSTEM FOR COMMAND AND CONTROL APPLICATIONS WITH PROGRAMMING LANGUAGE ABSTRACTION
Saridogan, Erhan, Turkish Navy, Turkey; Sensor Data Fusion and Integration of the Human Element; February 1999, pp. 9-1 - 9-12; In English; See also 19990092805; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

As processing and time requirements of computer systems increase over borders of single processor architectures, it is becoming more and more attractive to use distributed computing with additional real time capabilities. In several cases, traditional programming languages have become insufficient to build such systems easily, especially when basic software quality factors such as reliability, correctness, robustness, ease of design, development, testing and maintenance are concerned. In this paper basic issues relevant to distributed systems are discussed, similar systems and languages are compared, a new language with its supportive runtime systems is introduced. The new system provides a solution that hides implementation details from the programmer by embedding distribution and real-time issues within the programming language structure. In order to demonstrate the usage of the new language, basic requirements of distributed naval command and control systems are touched and a simple naval application design and part of the implementation is briefly explained.
Author
Command And Control; Distributed Parameter Systems; Programming Languages; Real Time Operation; Object-Oriented Programming

19990092812 Defence Evaluation Research Agency, Air Systems Sector, Farnborough, UK
NOVEL CONCEPTS FOR IDENTITY FUSION IN AN AIR COMBAT ENVIRONMENT
Arman, S. M., Defence Evaluation Research Agency, UK; Sensor Data Fusion and Integration of the Human Element; February 1999, pp. 10-1 - 10-8; In English; See also 19990092805; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

A concept is proposed for an identity fusion system to augment the current positional data fusion algorithm. Data from the aircraft's sensors are fused by an Extended Kalman Filter to develop tracks in an air combat environment. The formed tracks can be considered to be a direct isomorphic mapping of the real space entity onto a software object. By programming the software object with its own self beliefs, the ability to vary its behaviour in response to varying situations, a set of goals and the knowledge of how to achieve its goals, an identity declaration can be asserted. This combines the extendibility and reusability of a modular architecture with the flexibility and adjustability of artificial intelligence.
Author
Algorithms; Artificial Intelligence; Multisensor Fusion; Kalman Filters

19990092813 Daimler-Benz Aerospace A.G., Military Aircraft Div., Munich, Germany
MIDS TRIANGULATION AND DE-GHOSTING OF INTERSECTION POINTS
Ziegler, J. W. R., Daimler-Benz Aerospace A.G., Germany; Sachsenhauser, H., Daimler-Benz Aerospace A.G., Germany; Sensor Data Fusion and Integration of the Human Element; February 1999, pp. 11-1 - 11-18; In English; See also 19990092805; Original contains color illustrations; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

Multi-functional Information Distribution System (MIDS)-Triangulation denotes a triangulation procedure to determine the range of ownship spokes by means of spokes and/or kinematically ranged tracks of other platforms. It is a method, which is especially suitable to determine the position of jammers. This paper develops a method to determine in three steps the range of target/spoke to the own aircraft. The first step consist in the calculation of the geometric intersection points. In the next step, the geometric intersection points will be investigated whether they behave as real existing targets by means of physical parameters. To this purpose an evaluation function will be introduced, indicating the measure of believe for an existing and therefore known target, which behaves like a calculated geometric intersection point. The set of believable intersection points will then be tested on association of ownship spokes with MIDS spokes. The association test (or deghosting test) decides whether an ownship spoke can be determined unambiguously or not. Crucial for the hit rate of successful triangulation is the geometric constellation of the MIDS platforms to the ownship. Simulation results prove the correctness and efficiency of the developed method.
Author
Information Systems; Triangulation; Mapping

19990092814 Thomson-CSF, Radars and Contre-Mesures, Elancourt, France
SUBJECTIVE INFORMATION GIVEN BY USER IN BEARINGS-ONLY TARGET MOTION ANALYSIS
Spigai, Marc, Thomson-CSF, France; Grandin, Jean-Francois, Thomson-CSF, France; Sensor Data Fusion and Integration of the Human Element; February 1999, pp. 12-1 - 12-6; In English; See also 19990092805; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

The Bearings Only Target Motion Analysis (BTMA) problem with two observers on the ground consists of estimating the position and velocity of maneuvering targets from bearings only measurements corrupted by noise. In the entire process, there are two parts: first association of the measurements on each observer then fusion of tracks made by each observer in order to find the trajectory of the targets. Fusion performances are highly dependent on the trajectory estimation algorithm. In some cases, conditions of interception are very bad: few measurements, targets hidden by hill, etc. One way to improve performances is to introduce subjective information coming from user's expertise of external processes. We present here the application of a trajectory estimation algorithm based on the Hidden Markov Models (HMM) which is a global stochastic method where subjective information can easily be introduced.
Author
Algorithms; Estimating; Stochastic Processes; Targets; Trajectories; Markov Processes

19990092815 Defence Evaluation Research Agency, Systems Integration Dept., Farnborough, UK
INTEGRATION OF THE HUMAN OPERATOR INTO COMPLEX AIR SYSTEMS USING ALTERNATIVE CONTROL TECHNOLOGIES, 1
Rood, G. M., Defence Evaluation Research Agency, UK; Sensor Data Fusion and Integration of the Human Element; February 1999, pp. 13-1 - 13-10; In English; See also 19990092805; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

In general, a combat aircraft can be described as a manueverable airborne weapons platforms, which contain a series of electronic and other systems with which the aircraft is controlled, navigated, weapons selected, etc. and a series of systems which provide protection for the aircrew throughout the performance envelope of the aircraft and when emergency escape is unavoidable. Most aircraft platforms have an operation life of over 20 years - some a longer and in this timescale, although the basic platform does not significantly alter - mainly for costs reasons - the avionics and crew support systems fits can continue to advance a number of generation - which can allow the airframe to retain its operational competitiveness against newer designs. The speed and capacity of future avionic systems, themselves increasing in complexity, will result in the amount of information output heavily increased. This is often all fed to a single pilot who is flying the aircraft close to the ground at around 450 knots or more, perhaps in bad weather at night, and the flying process alone needs continuous monitoring. As the capabilities of aircraft will continue to increase through the use of more sophisticated, and a wider range of sensors, and control through software increases the ability to control the aircraft systems will inevitably require an even greater number of controls - many of these being necessary, at least in principle on the Hands On Throttle and Stick (HOTAS) controls, as many are time critical and need to operate eyes-out. The rise in the number of avionic systems and the consequent number of manual switching operation necessary during critical phases of operation has resulted in a gradual increase in the numbers of switches/controls per crew member in the cockpit. There are some indications from aircrew that the numbers of functions are becoming both difficult to remember - needing more training and sometimes difficult to operate with either standard aircrew gloves. What is required are alternative methods of inputting data to aircraft avionic systems, particularly if the provide a more natural and quicker interface. Of the more mature alternative control technologies, voice recognition and head tracking are both in operational flight and experimental flight depending upon the level of sophistication of the technology and are both technically mature enough for full operational use, with research on the next generation, higher capability systems in progress.
Derived from text
Avionics; Cockpits; Complex Systems; Flight Crews; Pilot Support Systems; Aircraft Pilots; Control Equipment; Control Systems Design; Aircraft Control

19990092816 Technische Univ., Inst. of Flight Guidance and Control, Brunswick, Germany
FUSION AND DISPLAY OF DATA ACCORDING TO THE DESIGN PHILOSOPHY OF INTUITIVE USE
Ardey, Goetz F., Technische Univ., Germany; Sensor Data Fusion and Integration of the Human Element; February 1999, pp. 14-1 - 14-7; In English; See also 19990092805; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

Microelectronics, over a decade ago, have forced their way into military and airliner cockpits. On the military side, the physical contest prevailed; on the civilian side economic competition was the driver leading the evolution from the analog to the digital cockpit. In today state of the art military and civilian transportation aircraft, one can hardly find any information from a pilot's wish list, that is not provided by a sensor already installed. Despite this technical ability, there is still something wrong when according to the aviation accident statistics, human factors is often the ultimate reason for crashes. But this depends on the definition of 'Human factors'. It is well known, that even highly trained professional pilots abilities can easily be reduced to amateur status under excessive mental stress. In these situations the human mind only accepts intuitively perceived information as the basis for actions. Therefore it is vital, that new avionics with their inert tendency to become complex are carefully developed along the principles of intuitive use. This paper describes several parts of a project comprising the development of a new cockpit for general aviation aircraft. It focuses on aspects of the target group, design philosophy, and low costs.
Author
Aircraft Accidents; Avionics; Cockpits; Human Factors Engineering; Microelectronics; Stress (Psychology); Aircraft Instruments; Pilot Support Systems

19990092820 Daimler-Benz Aerospace A.G., Airborne Systems Div., Ulm, Germany
THE MULTI-SENSOR INTEGRATION SYSTEM FOR NATO E-3A MID-TERM MODERNISATION
Roschmann, Hansjoerg, Daimler-Benz Aerospace A.G., Germany; Wacker, Uwe, Daimler-Benz Aerospace A.G., Germany; Sensor Data Fusion and Integration of the Human Element; February 1999, pp. 18-1 - 18-9; In English; See also 19990092805; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

In the NATO E-3A Mid-Term modernization Program in te Airborne Systems Division (ASD) of Daimler-Benz Aerospace (DASA) was selected in a competitive process to contribute three work packages. These packages comprise the Multi-Sensor INtegration, Tracking and Identification Software as well as the AWACS Mission Computer and the Multi-Sensor Integration Computer hardware. When the selection process for the individual work packages was completed, the Statement of Work (SOW) for DASA ASD was extended in order to deliver a single integrated subsystem comprising both, hardware and software. The requirements in the NATO E-3A Mid-term Modernization Program call for real-time integration of all available information pertaining to one real world object, in particular geometric kinematics and signature data. The new system shall improve tracking quality and additionally give automatic identification/classification of targets in order to significantly reduce operator workload. The Multi-Sensor Integration function as it will be realized for AWACS will use data of the primary surveillance radar, secondary surveilance radar (IFF), data of passive electronic support measures and crosstold data of several links including Link-16. All these data are input to a data fusion process in order to generate a clear and true picture of the real world situation. This paper will present an overview of the technical concepts and the selected solutions for the multi-sensor integration task. It will show how the multi-sensor integration is performed and what the critical issues are in the course of data fusion. Furthermore it will briefly outline the test

concepts which will be used for the final acceptance of the system. Author

Computer Programs; Iff Systems (Identification); Multisensor Applications; Multisensor Fusion; Radar Data; Aircraft Detection; Secondary Radar; Surveillance Radar

19990092823 Turkish Navy, Dept. of Software Development, Turkey

UTILIZING CORBA CONCEPTS FOR COMMAND AND CONTROL SYSTEMS

Balci, Metin, Turkish Navy, Turkey; Kuru, Selahattin, Bogazici Univ., Turkey; Sensor Data Fusion and Integration of the Human Element; February 1999, pp. 23-1 - 23-11; In English; See also 19990092805; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

As Command and Control systems are getting larger and more complex, reliable, modifiable, scalable, platform and operating system independent, distributed and non-proprietary programming environment becomes an important issue for system engineers and developers. Although CORBA (Common Object Request Broker Architecture) concept and its implementations offer a platform and operating system independent software architecture for large scale systems, there are still some important missing issues such as reliability, fault tolerancy and real-time fast enough QoS Behaviour. In this paper, we present our evaluation results based on our experience and efforts in designing a C2 system utilizing currently available COTS technologies as much as possible and propose an infrastructure to satisfy the reliability and fault tolerancy requirements of a C2 system software architecture with some additional domain interfaces over CORBA. We also present our overall software architecture that will utilize this infrastructure in C2 system domain Author

Architecture (Computers); Command And Control; Military Technology; Object-Oriented Programming; Software Engineering; Distributed Processing; Software Reliability; Real Time Operation; Onboard Data Processing; Computer Programming

20000032671 California Univ., San Diego, Computer Vision and Robotics Research Lab., La Jolla, CA USA

COMPUTATIONAL MODELS FOR SEARCH AND DISCRIMINATION: AN INTEGRATED APPROACH

Copeland, Anthony C., California Univ., San Diego, USA; Trivedi, Mohan M., California Univ., San Diego, USA; Search and Target Acquisition; March 2000, pp. 21-1 - 21-12; In English; See also 20000032651; Copyright Waived; Avail: CASI; A03, Hardcopy

This paper presents an experimental framework for evaluating metrics for the search and discrimination of a natural texture pattern from its background. Such metrics could help identify preattentive cues and underlying models of search and discrimination, and to evaluate and design camouflage patterns and automatic target recognition systems. Human observers were asked to view image stimuli consisting of various target patterns embedded within various background patterns. These psychophysical experiments provided a quantitative basis for comparison of human judgments to the computed values of target distinctness metrics. Two different experimental methodologies were utilized. The first methodology consisted of paired comparisons of a set of stimuli containing targets in a fixed location known to the observers. The observers were asked to judge the relative target distinctness for each pair of stimuli. The second methodology involved stimuli in which the targets were placed in random locations unknown to the observer. The observers were asked to search each image scene and identify suspected target locations. Using a prototype eye tracking testbed. the Integrated Testbed for Eye Movement Studies, the observers' fixation points during the experiment were recorded and analyzed. For both experiments. the level of correlation with the psychophysical data was used as the basis for evaluating target distinctness metrics. Overall, of the set of target distinctness metrics considered, a metric based on a model of image texture was the most strongly correlated with the psychophysical data.
Author

Visual Perception; Target Recognition; Human Performance; Performance Prediction; Target Acquisition; Mathematical Models; Visual Discrimination; Pattern Recognition

20000032675 Defence Evaluation Research Agency, Protection and Performance Dept., Farnborough, UK

A PHYSICS BASED BROADBAND SCENE SIMULATION TOOL FOR CCD ASSESSMENT

Moorhead, I. R., Defence Evaluation Research Agency, UK; Gilmore, M. A., Defence Evaluation Research Agency, UK; Oxford, D., Defence Evaluation Research Agency, UK; Filbee, D., Hunting Engineering Ltd., UK; Stroud, Colin, Hunting Engineering Ltd., UK; Hutchings, G., Hunting Engineering Ltd., UK; Kirk, A., Hunting Engineering Ltd., UK; Search and Target Acquisition; March 2000, pp. 25-1 - 25-8; In English; See also 20000032651; Copyright Waived; Avail: CASI; A02, Hardcopy

Assessment of Camouflage, Concealment and Deception (CCD) methodologies is a non trivial problem; conventionally the only method has been to carry out field trials, which are both expensive and subject to the vagaries of the weather. In recent years computing power has increased, such that there are now many research programmes using synthetic environments for CCD assessments. Such an approach is attractive; the user has complete control over the environment parameters and many more scenarios can be investigated. The UK Defence Evaluation and Research Agency is currently developing a synthetic scene generation tool for assessing the effectiveness of air vehicle camouflage schemes. The software is sufficiently flexible to allow it to be used in a broader range of applications, including full CCD assessment. The synthetic scene simulation system (CAMEO-SIM) has been developed, as an extensible system, to provide imagery within the 0.4 - 14 micron spectral band with as high a physical fidelity as possible. It consists of a scene design tool, an image generator, which incorporates both radios and ray-tracing processes, and an experimental trials tool. The scene design tool allows the user to develop a three-dimensional representation of the scenario of interest from a fixed viewpoint. Target(s) of interest can be placed anywhere within this 3-D representation and may be either static or moving. Different illumination conditions and effects of the atmosphere can be modelled together with directional reflectance effects. The user has complete control over the level of fidelity of the final image. The output from the rendering tool is a sequence of radiance maps which may be used by sensor models, or for experimental trials in which observers carry out target acquisition tasks. The software also maintains an audit trail of all data used to generate a particular image, both in terms of material properties used and the rendering options chosen.
Author

Camouflage; Target Acquisition; Charge Coupled Devices; Scene Generation; Imagery; Target Recognition; Simulation; Deception

20000032676 Defence Clothing and Textiles Agency, Science and Technology Div., Colchester, UK

AN INVESTIGATION INTO THE APPLICABILITY OF COMPUTER-SYNTHESISED IMAGERY FOR THE EVALUATION OF TARGET DETECTABILITY

Ashforth, M., Defence Clothing and Textiles Agency, UK; Search and Target Acquisition; March 2000, pp. 26-1 - 26-4; In English; See also 20000032651; Copyright Waived; Avail: CASI; A01, Hardcopy

In the course of an earlier study of the influences on an observer's performance in target detectability assessments, the statistical analysis of the data suggested that there was a difference in the influences at work on an observer between the detection of targets in a real scene and the detection of targets in computer-generated (synthetic) images. Since synthetic imagery is increasingly used in this field, this is an important result. The work described in this report is a further analysis of the original data with the aim of studying more closely this difference. Analysis showed that there is indeed a marked difference between the influence of the observers' visual acuity on their performance in the two types of detection task. The reason is that there is less detailed clutter in synthetic images, which alleviates much of the decision-making an observer has to undergo in detecting a target in a real-scene image. In the synthetic case, the target is either seen or not seen and there is much less uncertainty. This uncertainty, which attends real target detection, swamps any measurable influences on an observer's relative performance in the real-scene case. The conclusion is that computer-generated images used for the evaluation of low-contrast target detection should contain much more clutter detail than at present.
Author

Target Acquisition; Camouflage; Imagery; Computer Techniques; Target Recognition; Visual Acuity; Visual Perception

20000032868 NASA Lewis Research Center, Cleveland, OH USA
ROTORCRAFT DAMAGE TOLERANCE EVALUATED BY COMPUTATIONAL SIMULATION
Chamis, Christos C., NASA Lewis Research Center, USA; Minnetyan, Levon, Clarkson Univ., USA; Abdi, Frank, Alpha Star Corp., USA; Application of Damage Tolerance Principles for Improved Airworthiness of Rotorcraft; February 2000, pp. 12 - 1 - 12 - 13; In English; See also 20000032859; Copyright Waived; Avail: CASI; A03, Hardcopy

An integrally stiffened graphite/epoxy composite rotorcraft structure is evaluated via computational simulation. A computer code that scales up constituent micromechanics level material properties to the structure level and accounts for all possible failure modes is used for the simulation of composite degradation under loading. Damage initiation, growth, accumulation, and propagation to fracture are included in the simulation. Design implications with regard to defect and damage tolerance of integrally stiffened composite structures are examined. A procedure is outlined regarding the use of this type of information for setting quality acceptance criteria, design allowables, damage tolerance, and retirement-for-cause criteria.
Author
Composite Structures; Crack Initiation; Cylindrical Shells; Damage; Simulation; Tolerances (Mechanics); Graphite-Epoxy Composites; Rotary Wing Aircraft; Computer Programs; Failure Modes; Micromechanics

20000037891 Delegation Generale de l'Armement, Architecture des Systemes de Drones, Paris, France
TOOLS FOR OPTIMIZATION AND VALIDATION OF SYSTEM ARCHITECTURE AND SOFTWARE
Fargeon, C., Delegation Generale de l'Armement, France; Development and Operation of UAVs for Military and Civil Applications; April 2000, pp. 3-1 - 3-22; In English; See also 20000037887; Copyright Waived; Avail: CASI; A03, Hardcopy

UAV systems architectures rank among the most complex ones with high safety requirements. Some new software tools have recently emerged that are worth to be known. This lecture was given to advertise four of them on the following topics : 1) Static verification of real time software, to avoid run-time errors, typically what happen for Ariane V ; 2) Simulation of real time architecture to optimize conception and validate the final choice ; 3) edition of command and control software with interpreted properties like on-line automatic reprogramming ; 4) optimization under constraints for continuous and discrete processes.
Author
Architecture (Computers); On-Line Systems; Command And Control; Program Verification (Computers); Safety

20000061434 Rensselaer Polytechnic Inst., Mechanical Engineering, Aeronautical Engineering and Mechanics, Troy, NY USA
SOFT COMPUTING IN MULTIDISCIPLINARY AEROSPACE DESIGN: NEW DIRECTIONS FOR RESEARCH
Hajela, Prabhat, Rensselaer Polytechnic Inst., USA; Aerodynamic Design and Optimisation of Flight Vehicles in a Concurrent Multi-Disciplinary Environment; June 2000, pp. 17-1 - 17-13; In English; See also 20000061419; Copyright Waived; Avail: CASI; A03, Hardcopy

There has been increased activity in the study of methods for multidisciplinary analysis and design. This field of research has been a busy one over the past decade, driven by advances in computational methods and significant new developments in computer hardware. There is a concern, however, that while new computers will derive their computational speed through parallel processing, current algorithmic procedures that have roots in serial thinking are poor candidates for use on such machines - a paradigm shift is required! Among new advances in computational methods, soft computing techniques have enjoyed a remarkable period of development and growth. Of these, methods of neural computing, evolutionary search, and fuzzy logic have been the most extensively explored in problems of multidisciplinary analysis and design. The paper will summarize important accomplishments to-date, of neurocomputing, fuzzy-logic, and evolutionary search, including immune network modeling, in the field of multidisciplinary aerospace design.
Author
Algorithms; Computation; Fuzzy Systems; Aircraft Design; Hardware

20000061451 DaimlerChrysler Aerospace A.G., Ottobrun, Germany
RAPID GENERATION OF CONCEPTUAL AND PRELIMINARY DESIGN AERODYNAMIC DATA BY A COMPUTER AIDED PROCESS
Fornasier, Luciano, DaimlerChrysler Aerospace A.G., Germany; Gottmann, Thomas, DaimlerChrysler Aerospace A.G., Germany; Aerodynamic Design and Optimisation of Flight Vehicles in a Concurrent Multi-Disciplinary Environment; June 2000, pp. 35-1 - 35-11; In English; See also 20000061419; Sponsored in part by the JULIUS partners; Copyright Waived; Avail: CASI; A03, Hardcopy

A multidisciplinary integration framework (MIDAS- an acronym for Multidisciplinary Integration for Design and Analysis Software) is developed for a quick and accurate assessment of aircraft performance. The system allows for the continues integration of the conceptual and preliminary design stages. The MIDAS system is starting from the definition of the configuration layout to provide basic aerodynamic data- for performance analysis, sizing, structural layout and early handling qualities. The first aerodynamic dataset is provided by an Excel-based module in a highly automated way. This data base can be updated by computational and experimental fluid dynamics findings. Another MIDAS module integrate the preparation of CFD meshes. The paper deals with the integration of aerodynamic methods within the aircraft design.
Author
Aircraft Design; Computer Aided Design; Computer Techniques; Reliability Analysis

20010002522 Research and Technology Organization, Human Factors and Medicine Panel, Neuilly-sur-Seine, France
THE CAPABILITY OF VIRTUAL REALITY TO MEET MILITARY REQUIREMENTS *[LA CAPACITE DE LA REALITE VIRTUELLE A REPONDRE AUX BESOINS MILITAIRES]*
November 2000; 174p; In English; 5-9 Dec. 1997, Orlando, FL, USA; See also 20010002523 through 20010002547; The CD-ROM contains full text document in PDF format; Original contains color illustrations
Report No.(s): RTO-MP-54; AC/323(HFM)TP/24; ISBN 92-837-1046-0; Copyright Waived; Avail: CASI; A08, Hardcopy; A02, Microfiche; C01, CD-ROM

The purpose of the workshop was to examine military requirements for Virtual Reality technology, consider human factors issues in the use of Virtual Reality and review recent research in development of Virtual Reality applications to meet military needs. The workshop was organized into three day long sessions. The first day focused on military applications for Virtual Reality systems and identified particular requirements for Human Factors research to meet the requirements. The second day examined Human Factors issues in the use of Virtual Reality technology. Presentations discussed sensory interfaces, measures of effectiveness, importance of the sensation of presence, and cybersickness. The third day reviewed assessment methods and applications research. Speakers reviewed existing or completed Virtual Reality projects designed to meet military needs. The papers discussed how the projects overcame human factors problems and how their effectiveness was evaluated. Virtual Reality technology is of great interest to the military. Requirements for its use encompass a wide range of applications including concept development of systems for dismounted combatants, mission rehearsal for special operations, training ship handling skills, telerobotics, and practicing military medical procedures. Virtual Reality's success in meeting these needs will be determined by the ability of its human-computer interfaces to provide the means necessary to deliver stimuli and allow appropriate responses from those using it. These human factors issues were the focus of the workshop. The workshop pointed to areas that require further research and development in order for Virtual Reality to meet its potential for the military.
Author
Human Factors Engineering; Human-Computer Interface; Virtual Reality; Computerized Simulation; Motion Simulation

20010002524 Office of Naval Research, Arlington, VA USA
US NAVY AND MARINE CORPS REQUIREMENTS AND CHALLENGES: VIRTUAL ENVIRONMENT AND COMPONENT TECHNOLOGIES
Allard, Terry, Office of Naval Research, USA; The Capability of Virtual Reality to Meet Military Requirements; November 2000, pp.

2-1 - 2-5; In English; See also 20010002522; Copyright Waived; Avail: CASI; A01, Hardcopy

Current military requirements for simulation-based training and optimized personal displays provide a compelling opportunity for implementation of virtual environment technologies. Near term applications for VE include land, sea and air training systems that will ultimately be used in a geographically distributed fashion for team training, mission planning and mission rehearsal. Stand-alone training systems will complete a seamless simulation-based training continuum from the schoolhouse to pierside and shipboard, augmenting the current Navy and Marine Corps emphasis on embedded training in operational systems. Virtual environment training systems have the great advantages of compactness, deployability, software reconfigurability and affordability when compared to conventional dedicated simulator systems. These advantages will lead to more widespread and available training capability. Careful task analyses, human-centered design principles and methods and better performance metrics will be needed in order to meet these emerging requirements. A continuing challenge for VE training systems is to demonstrate the value added of immersive versus more conventional desktop delivery systems. Further work needs to be done to evaluate the potential for shipboard VE systems and safety guidelines for their use. However, with the rapid advances in display technologies and computing power in industry today, we can expect VE technologies to continue to grow in value and availability as we enter the next century.

Derived from text

Requirements; Equipment Specifications; Training Simulators; Virtual Reality; Computerized Simulation; Motion Simulation

20010002527 Department of Defense, Center for Land Warfare, Washington, DC USA

USING THE VIRTUAL REALITY MARKUP LANGUAGE (VRML) TO UNDERSTAND THE US ARMY'S SIMULATION AND TRAINING DOMAIN

Stone, George F., III, Department of Defense, USA; The Capability of Virtual Reality to Meet Military Requirements; November 2000, pp. 5-1; In English; See also 20010002522; Copyright Waived; Avail: CASI; A01, Hardcopy

Knowledge gained via the technology explosion continues to grow at an exponential rate. The size of all knowledge bases will become larger and more difficult to design. The Functional Description of the Battlespace (FDB) is the Army domain modeled for use in simulation development, Warfighter's Simulation 2000. The database that must be designed to describe everything that the Army does is going to be very large. Military unit descriptions, mission models, task process descriptions and other models reside within a large warehouse of data, models, algorithms, information and knowledge. FDB users currently navigate on two-dimensional screens that use standard hypertext markup languages. In order to lead the FDB user in a more efficient and effective manner, a three-dimensional mapping and visualization of the FDB contents are sought. The gain will be increased understanding of the FDB knowledge warehouse. Using the virtual reality markup language (VRML), a virtual map and guide of the FDB will teach the abstract concepts inherent in complex domain modeling.

Derived from text

Motion Simulation; Motion Simulators; Virtual Reality; Document Markup Languages; Hypertext; Training Simulators

20010002528 Old Dominion Univ., Virginia Modeling, Analysis and Simulation Center, Norfolk, VA USA

TRANSFERRING VR TECHNOLOGY BETWEEN MILITARY AND NON-MILITARY APPLICATIONS

Mastaglio, Thomas W., Old Dominion Univ., USA; The Capability of Virtual Reality to Meet Military Requirements; November 2000, pp. 6-1 - 6-4; In English; See also 20010002522; Copyright Waived; Avail: CASI; A01, Hardcopy

Virtual Reality (VR) technology for commercial applications has been oversold to the public during the past 2 to 3 years. There have, however, been relatively few success stories outside of entertainment, but that does not mean VR cannot meet the requirements of non-military applications. It is important that we take a broader view of VR than helmet-mounted displays and wearable technology, one that includes interfaces able to display high fidelity 3D environments and models. In this paper I discuss the methodologies for accomplishing technology transfer. These include cooperative agreements, corporate funded R&D, and government funded initiatives. The requirements of commercial application domains, including industrial operations, government (non defense) operations, healthcare and entertainment are discussed and related to military training systems. Last 1 will propose ways that these two communities can work together on joint research and development, transferring technology bi-directionally, and the use of forums to enhance dialog and discussion. This paper is intended to stimulate a discussion of issues (such as intellectual property) which are appropriate agenda items for future joint discussions and workshops supported by both defense and non-defense VR developers.

Author

Technology Transfer; Technology Utilization; Military Technology; Education

20010002532 Essex Corp., Orlando, FL USA

CAPABILITY OF VIRTUAL ENVIRONMENTS TO MEET MILITARY REQUIREMENTS

Kennedy, Robert S., Essex Corp., USA; Stanney, Kay M., University of Central Florida, USA; Lawson, Ben D., Naval Aerospace Medical Research Lab., USA; The Capability of Virtual Reality to Meet Military Requirements; November 2000, pp. 10-1 - 10-3; In English; See also 20010002522; Copyright Waived; Avail: CASI; A01, Hardcopy

The DOD and NASA are considering virtual environment (VE) technology for use in forward deployable and remote training devices. Yet, many of these VE devices, particularly those which employ helmet-mounted displays, have an adverse effect on users, eliciting motion sickness and other sequelae (e.g., Pausch, Crea, & Conway, 1992; Kennedy, Lane, Lilienthal, Berbaum, & Hettinger, 1992). These symptoms, now called cybersickness (McCauley & Sharkey, 1992) could retard development of VE technology and limit its use as a training tool. Motion sickness is known to be polysymptomatic and in scoring self-reports we have found there to be reliably different profiles of sickness in simulators, at sea, in space, and in VE (Kennedy, Lane, Berbaum, & Lilienthal, 1993). Furthermore, recent research in our laboratories implies that cybersickness may involve multiple functional pathways. The first pathway is related to ill-effects upon the autonomic nervous system or ANS (Money, Lackner, & Cheung, 1996). According to sensory conflict theory (Reason & Brand, 1975), the ANS is provoked when sensory inputs from the visual, auditory, vestibular, or somatoceptors are uncorrelated or incompatible. This is the case when one is exposed to the certain sensory rearrangements in a virtual environment. Such rearrangements can trigger the 'emetic brain response' (Oman, 1991) causing vomiting, perspiration, nausea, pallor, salivation, and drowsiness.

Derived from text

Environment Simulation; Virtual Reality; Motion Simulation; Helmet Mounted Displays; Motion Simulators; Training Simulators

20010002535 Institute for Human Factors TNO, Soesterberg, Netherlands

HOW REAL ARE VIRTUAL ENVIRONMENTS?: A VALIDATION OF LOCALIZATION, MANIPULATION AND DESIGN PERFORMANCE

Werkhoven, Peter, Institute for Human Factors TNO, Netherlands; The Capability of Virtual Reality to Meet Military Requirements; November 2000, pp. 13-1 - 13-3; In English; See also 20010002522; Copyright Waived; Avail: CASI; A01, Hardcopy

Immersive simulation techniques such as Virtual Environments (VE) can revolutionize human factors engineering and training projects provided that they are carefully validated. Is human performance in the virtual world the same as in the real world? When visual aspects perceived on a virtual ship differ from those perceived on a real ship, human factors engineering studies may yield non-optimal designs. When interactions with virtual worlds are not natural, training may not transfer to the real world. I will discuss three studies that compared human task performance in real and virtual (HMD) environments. First, we carried out spatial perception experiments and measured localization performance: how well can people indicate the center point between two objects in identical virtual and real environments. Second, manipulation performance was measured: how well can people grab, turn and position objects in virtual environments and what adaptation effects occur when returning to the real world. Third, we compared the assessment of ergonomic aspects of identical virtual and real ship bridges. Discrepancies found between the results for the real and the virtual bridge are

discussed in terms of challenges with respect to the quality of head-mounted display optics and tracking devices and, most importantly, with respect to natural interfaces needed for manipulation (virtual hand control) and for moving around in virtual worlds (intuitive navigation methods).
Author
Virtual Reality; Environment Simulation; Human Factors Engineering; Education

20010002537 Management Systems and Training Technologies Co., USA
DEVELOPMENT OF A VIRTUAL ENVIRONMENT SOFTWARE TESTBED USING COMMERCIAL-OFF-THE-SHELF SOFTWARE COMPONENTS
Davidson, Scott W., Management Systems and Training Technologies Co., USA; The Capability of Virtual Reality to Meet Military Requirements; November 2000, pp. 15-1 - 15-4; In English; See also 20010002522; Copyright Waived; Avail: CASI; A01, Hardcopy

The goals of the Virtual Environment Training Technology (VETT) program are to develop, demonstrate and evaluate the use of Virtual Environment (VE) component technologies for navy training applications. A key part of this effort is the development of a testbed, performed by Management Systems and Training Technologies (MSTT), for investigating the benefits of using VE interfaces to improve naval training while reducing training-system costs. This paper describes the technology components integrated by MSTT that provide a tool for training effectiveness research at the Naval Air Warfare Center Training Systems Division (NAWCTSD) in Orlando, Florida. The development approach used for the testbed is to integrate off-the-shelf tools into one cohesive software platform. Applications developed on the testbed include a multi-modal Virtual Electronic Systems Trainer, a spatialized audio location task, and relative motion experiment for surface ship handling. Current efforts on the testbed are directed towards open-water and restricted maneuvering surface ship handling.
Derived from text
Product Development; Computer Programs; Virtual Reality; Environment Simulation; Training Simulators

20010002539 Navy Personnel Research and Development Center, San Diego, CA USA
APPLICATION OF VIRTUAL ENVIRONMENT (VE) TECHNOLOGY FOR EXPLOSIVE ORDNANCE DISPOSAL (EOD) TRAINING
Ryan-Jones, David L., Navy Personnel Research and Development Center, USA; Robinson, Eleanor, Navy Personnel Research and Development Center, USA; The Capability of Virtual Reality to Meet Military Requirements; November 2000, pp. 17-1 - 17-3; In English; See also 20010002522; Copyright Waived; Avail: CASI; A01, Hardcopy

The primary job of an EOD technician is to deal with unexploded ordnance. There are over 20,000 different technical publications covering items in the ordnance inventory. The large number and variety of ordnance effectively precludes memorizing the identifying characteristics and render-safe and disposal procedures for more than a few common items. Although ordnance can be blown up in place, each technician must be trained to disarm and dispose of ordnance as if the conditions do not allow it to be blown up in place.
Derived from text
Virtual Reality; Environment Simulation; Training Simulators; Education

20010002541 Research Development Corp., Herndon, VA USA
AN INTELLIGENT TUTORING SIMULATION FOR MILITARY OPERATIONS IN URBAN TERRAIN
Leddo, John, Research Development Corp., USA; Kolodziej, James, Research Development Corp., USA; The Capability of Virtual Reality to Meet Military Requirements; November 2000, pp. 19-1 - 19-7; In English; See also 20010002522; Copyright Waived; Avail: CASI; A02, Hardcopy

Simulation has played a major role in military training. Distributed Interactive Simulation (DIS) allows multiple trainees to interact in real time on a common training problem. While DIS is a powerful training tool, a trainer is typically required to review trainee performance and make the appropriate teaching and remedial points. As training scales to larger and larger exercises, the trainer will naturally focus on general team performance at the expense of individual training needs. Intelligent tutoring systems (ITSs) have focused on providing instruction on a one-to-one basis. Integrating DIS and ITS technologies offer the opportunity to capitalize on the strengths of both: the ability to conduct large scale team exercises while providing each trainee with personalized instruction. The present paper reports a Phase II Small Business Innovation Research (SBIR) project, sponsored by the U.S. Army Simulation, Training and Instrumentation Command (STRICOM) in which an Intelligent Tutoring Simulation(sup TM) was developed to train Army Infantry squad and fire team leaders the skills they need to cooperatively perform military operations in urban terrain (MOUT).
Author
Military Operations; Training Simulators; Virtual Reality; Environment Simulation; Distributed Interactive Simulation; Education

20010002543 Defence and Civil Inst. of Environmental Medicine, North York, Ontario Canada
EXPLORATORY USE OF VR TECHNOLOGIES FOR TRAINING HELICOPTER DECK-LANDING SKILLS
Magee, Lochlan E., Defence and Civil Inst. of Environmental Medicine, Canada; The Capability of Virtual Reality to Meet Military Requirements; November 2000, pp. 21-1 - 21-3; In English; See also 20010002522; Copyright Waived; Avail: CASI; A01, Hardcopy

Canadian Forces (CF) pilots and landing safety officers require intensive training to develop the individual and team skills required for safe helicopter deck landings. These skills are currently acquired at sea, following individual training with independent simulators unequipped with visual displays. DCIEM is exploring the feasibility of using commercial, off-the-shelf technologies as the essential components for simulators for training the pilot of the Sea King helicopter and the landing safety officer (LSO) of a Canadian Patrol Frigate (CPF). The objective of this project is to assess virtual reality and computer networking technologies that could be exploited in the development of a federation of interconnected, low-cost simulators. The human factors of visual and motion cueing, and coupling of the simulators, present the major technical challenges to the project#s success. This paper will describe the exploratory development models, some preliminary reactions, and the experimental plan proposed to assess the training effectiveness of the helicopter simulators.
Author
Virtual Reality; Environment Simulation; Training Simulators; Education; Pilot Training; Sh-3 Helicopter; Human Factors Engineering

20010002544 Houston Univ., Dept. of Computer Sciences, TX USA
SHARED VIRTUAL ENVIRONMENTS FOR COLLECTIVE TRAINING
Loftin, R. Bowen, Houston Univ., USA; The Capability of Virtual Reality to Meet Military Requirements; November 2000, pp. 22-1 - 22-6; In English; See also 20010002522; Original contains color illustrations; Copyright Waived; Avail: CASI; A02, Hardcopy

Historically NASA has trained teams of astronauts by bringing them to the Johnson Space Center in Houston to undergo generic training, followed by mission-specific training. This latter training begins after a crew has been selected for a mission (perhaps two years before the launch of that mission). While some Space Shuttle flights have included an astronaut from a foreign country, the International Space Station will be consistently crewed by teams comprised of astronauts from two or more of the partner nations. The cost of training these international teams continues to grow in both monetary and personal terms. Thus, NASA has been seeking alternative training approaches for the International Space Station program. Since 1994 we have been developing, testing, and refining shared virtual environments for astronaut team training, including the use of virtual environments for use while in or in transit to the task location. In parallel with this effort, we have also been preparing applications for training teams of military personnel engaged in peacekeeping missions. This paper will describe the applications developed to date, some of the technological challenges that have been overcome in their development, and the research performed to

guide the development and to measure the efficacy of these shared environments as training tools.
Author
Astronaut Training; Training Simulators; Flight Simulation; Flight Training; Virtual Reality; Environment Simulation

20010002545 Etablissement Technique d'Angers, Montreuil-Juigne, France
FRENCH MILITARY APPLICATIONS OF VIRTUAL REALITY
Papin, Jean Paul, Etablissement Technique d'Angers, France; Hue, Pascal, Etablissement Technique d'Angers, France; The Capability of Virtual Reality to Meet Military Requirements; November 2000, pp. 23-1 - 23-3; In English; See also 20010002522; Copyright Waived; Avail: CASI; A01, Hardcopy

France is now applying virtual reality techniques to military purposes. In parallel, France is conducting studies related to the psychological effects of immersion. Our approach is based on the creation of synthetic environments in which men are more or less immersed. Besides we have been searching for the means that will give the best price/quality ratio. This resulted in creating environments which are both simplified and improved with respect to the actual environment. This document describes some current applications.
Derived from text
France; Military Technology; Armed Forces (Foreign); Virtual Reality; Environment Simulation

20010002546 Naval Air Warfare Center, Training Systems Div., Orlando, FL USA
FORMATIVE EVALUATIONS OF THE VESUB TECHNOLOGY DEMONSTRATION SYSTEM
Hays, Robert T., Naval Air Warfare Center, USA; The Capability of Virtual Reality to Meet Military Requirements; November 2000, pp. 24-1 - 24-3; In English; See also 20010002522; Copyright Waived; Avail: CASI; A01, Hardcopy

Decreasing military budgets, reduced training infrastructure, and increasing complexity of weapon systems and missions mandate the exploitation of innovative advanced training technologies. In recent years, training developers have recognized the potential of virtual reality (VR), often called virtual environments (VE), as a flexible and effective training medium. A prime candidate area for examining the effectiveness and usability of VR systems is the training of the submarine surfaced ship handling task. Although land-based simulator facilities currently exist for training Submarine Piloting and Navigation teams, these systems do not provide detailed harbor and channel ship handling training for the Officer of the Deck (OOD). OOD training is primarily obtained from on-the-job experience, which is adversely impacted by the operational constraints of the Submarine Force, and the limited surfaced steaming time of submarines. Training that will expose junior officers to a variety of geographical and environmental conditions is very limited since most Commanding Officers place their most experienced OODs on watch during these challenging evolutions. Therefore, an alternative, high-fidelity, simulation-based training capability is needed. A VR-based simulation may provide this necessary capability if it is both effective and user-friendly.
Derived from text
Virtual Reality; Environment Simulation; Motion Simulation; Motion Simulators; Training Simulators; Education

20010002547 Physics and Electronics Lab. TNO, Command and Control and Simulation Div., The Hague, Netherlands
HMD BASED VIRTUAL ENVIRONMENTS FOR MILITARY TRAINING: TWO CASES
Kuijper, Frido, Physics and Electronics Lab. TNO, Netherlands; The Capability of Virtual Reality to Meet Military Requirements; November 2000, pp. 25-1 - 25-11; In English; See also 20010002522; Original contains color illustrations; Copyright Waived; Avail: CASI; A03, Hardcopy

This paper reports on two cases in which Head Mounted Display (HMD) based Virtual Environments (VE) are applied to military training. The first case deals with Forward Air Controller training, while the second case is aimed at Stinger training. Both applications are subjects of study within the VE research program of the TNO Physics and Electronics Laboratory and the TNO Human Factors Research Institute. For the Forward Air Controller (FAC) training application a feasibility study was recently performed. Based upon a task and training analysis, a prototype FAC training simulator was developed and evaluated. Evaluation results have encouraged both the Dutch armed forces and other NATO countries (UK, Belgium) to seriously consider the HMD based FAC simulator as a useful and effective training tool. The paper describes the simulator prototype and evaluation results, including the human factors issues that were addressed in this study. The Stinger training application is still in an early stage of development. Instigated by a demand of the Royal Netherlands Air Force, the research is focused on finding a suitable concept for a mobile training device. The paper describes a planned project (to start in 1998) that includes the development of an experimental system in order to evaluate several design alternatives. The evaluation has as a goal to determine how human performance is affected by the type of display system that is used, the overall system latency and the tracking accuracy.
Author
Helmet Mounted Displays; Virtual Reality; Environment Simulators; Environment Simulation; Training Simulators

20010003255 FGAN, Wachtberg-Werthhoven, Germany
THE ELECTRONIC SANDTABLE: AN APPLICATION OF VE-TECHNOLOGY AS TACTICAL SITUATION DISPLAY
Alexander, Thomas, FGAN, Germany; Gaertner, Klaus-Peter, FGAN, Germany; Usability of Information in Battle Management Operations; November 2000, pp. 12-1 - 12-10; In English; See also 20010003245; Copyright Waived; Avail: CASI; A02, Hardcopy

In future battlescape scenarios huge amounts of highly dynamic information will be available due to the technical development of sensor, communication, and information systems. This flood of available information may lead to mental overload of the military commander and cause a wrong mental model of the battlespace situation. Therefore advanced techniques for supporting the military commander and displaying complex tactical situation data in a clearly understandable way have to be developed and evaluated. At the Research Institute for Communication, Information Processing and Ergonomics (FKIE) of FGAN, a concept for preprocessing and visualizing incoming tactical data and three-dimensional geographical data has been developed. The concept includes the use of Virtual Environment-technology as a display system. This 'Electronic Sandtable (ELSA)' testbed, as described in this paper, is based on a semi-immersive display technology. It facilitates a plastic stereoscopic visualization of three-dimensional data. It has been developed to be used to simulate a sandtable as commonly used by the Armed Forces for tactical education and training. This paper presents the baseline concept of using VE-technology as an advanced tactical situation display. It is pointed out that, although the technology is commercially available, research in the area of ergonomics and human factors is essential for the advantageous use of such a system. The main ergonomic topics described in this paper include the stereoscopic visualization of the geographic and tactical data, the degree of abstraction and human operator interaction with the virtual scene on the 'Electronic Sandtable'.
Author
Information Systems; Military Technology; Technology Utilization; Information Management; Data Processing

20010003256 Defence Evaluation Research Agency, Farnborough, UK
VISUALIZING THE BATTLEFIELD WITH PANORAMIC DISPLAYS
Dudfield, H. J., Defence Evaluation Research Agency, UK; Macklin, C. M., Defence Evaluation Research Agency, UK; Fearnley, R. P., Defence Evaluation Research Agency, UK; Usability of Information in Battle Management Operations; November 2000, pp. 13-1 - 13-8; In English; See also 20010003245; Copyright Waived; Avail: CASI; A02, Hardcopy

This paper outlines ongoing research into the application of shared large screen displays (LSDs) for visualising the battlespace. This research was funded by the MOD's Corporate Research Programme 1999-2000 (TG5: Human Sciences and Synthetic Environments). Completeness and accuracy of information has the potential to enhance awareness of the situation and increases the probability of better decision making by the command team. Thus LSDs may lead to enhanced team situation awareness, and it is proposed that this in turn should lead to more effective decision making. The paper discusses panoramic displays in relation to the

potential benefits that would arise when military command teams use them. Understanding of the command team's information requirements is crucial to the operational advantage gained with LSDs. This paper also reports the outcome of a user requirements capture exercise, where users were required to consider their potential information display requirements for an LSD to be used in 2010.
Author
Display Devices; Information Systems; Military Technology; Warfare; Technology Utilization

20010003261 Air Force Research Lab., Human Effectiveness Directorate, Wright-Patterson AFB, OH USA
DIRECT MANIPULATION INTERFACE TECHNIQUES FOR USES INTERACTING WITH SOFTWARE AGENTS
Young, Michael, Air Force Research Lab., USA; Eggleston, Robert G., Air Force Research Lab., USA; Whitaker, Randall, Logicon Technical Services, Inc., USA; Usability of Information in Battle Management Operations; November 2000, pp. 19-1 - 19-10; In English; See also 20010003245; Copyright Waived; Avail: CASI; A02, Hardcopy

In this paper we provide an overview of our research investigating what functionality should be provided to users of a future Joint Battlespace Infosphere (JBI). We characterize and discuss the development of the JBI as a new form of automation that employs intelligent agents to autonomously seek, retrieve, and fuse information. We believe that the development of new types of direct manipulation interfaces are the best approach to achieving JBI goals of reducing decision time and manning while maintaining positive control over the command and control (C2) system. Further, we argue that the integration of direct manipulation interface techniques with interface agents will change the HCI from a mechanism to execute tasks into a decision-aid that supports cognitive information processing. We contextualize this discussion by providing an overview of the Air Force Research Laboratory's Human Interaction with Software Agents (HISA) project. This effort is developing a HCI for Air Mobility Command's (AMC) Tanker Airlift Control Center (TACC) that interacts with operational C2 systems through intelligent agents, similar to the manner of the proposed JBI.
Author
Command And Control; Information Systems; Information Management; Military Technology

20010019326 National Research Council of Canada, Software Engineering Group, Ottawa, Ontario Canada
COTS SOFTWARE EVALUATION TECHNIQUES
Dean, John C., National Research Council of Canada, Canada; Vigder, Mark R., National Research Council of Canada, Canada; Commercial Off-the-Shelf Products in Defence Applications 'The Ruthless Pursuit of COTS'; December 2000, pp. 9-1 - 9-6; In English; See also 20010019317
Report No.(s): ISBN 92-837-1049-5; Copyright Waived; Avail: CASI; A02, Hardcopy

Employing Commercial Off-the-Shelf (COTS) software products as components in large-scale long-lived systems has been proposed as a way to reduce both implementation and operating cost for the user communities. While this may be the case, the actual benefits have not been confirmed. However, there is factual evidence that some of the suggested cost savings will be offset by the need to address a new set of issues that are raised by the inclusion of COTS components. One of these is the need to evaluate candidates COTS systems early in the development life cycle. Our research is concentrated in the area of physical evaluation of candidate products, that is, actual testing of the products themselves. The purpose of this paper is to present a discussion of proposed evaluation techniques used to select COTS software components for systems development, to describe appropriate testing techniques for COTS candidates, and to propose an evaluation system which will provide support to ensure timely selection of suitable COTS products.
Author
Computer Programs; Evaluation; Commercialization; Performance Tests

20010019328 Missouri Univ., Dept. of Electrical and Computer Engineering, Rolla, MO USA
COTS SOFTWARE SUPPLIER IDENTIFICATION AND EVALUATION
Miller, Ann, Missouri Univ., USA; Commercial Off-the-Shelf Products in Defence Applications 'The Ruthless Pursuit of COTS'; December 2000, pp. 11-1 - 11-6; In English; See also 20010019317
Report No.(s): ISBN 92-837-1049-5; Copyright Waived; Avail: CASI; A02, Hardcopy

There has been a consistent trend to field increasingly large systems. Largeness requires a longer development cycle that is in direct conflict with the need to field systems quickly. Several approaches have been developed to reduce time-to-market. One of the most notable methods in reaction to time-to-field pressures is the inclusion of Commercial-Off-the-Shelf (COTS) as well as Government-Off-the-Shelf (GOTS) software packages to perform some of the functions of these new 'mega-systems'. This paper addresses some of the advantages and pitfalls of the inclusion of COTS components and discusses the need for an evaluation not only of the COTS component but also of the COTS supplier. The paper concludes with some of the lessons learned from the use of COTS incorporation and of supplier assessments over a ten-year span of commercial and government acquisitions.
Author
Computer Programs; Commercialization; Evaluation; Product Development

20010019329 Defence Research Establishment Valcartier, Valcartier, Quebec Canada
DETECTION OF MALICIOUS CODE IN COTS SOFTWARE VIA CERTIFYING COMPILERS
Charpentier, Robert, Defence Research Establishment Valcartier, Canada; Salois, Martin, Defence Research Establishment Valcartier, Canada; Commercial Off-the-Shelf Products in Defence Applications 'The Ruthless Pursuit of COTS'; December 2000, pp. 13-1 - 13-7; In English; See also 20010019317
Report No.(s): ISBN 92-837-1049-5; Copyright Waived; Avail: CASI; A02, Hardcopy

Information technology is more and more a vitally important underpinning to our economy and to our society. It is embedded in everyday applications and animates a wide class of systems that range from small to large and from simple to extremely sophisticated. Among the probable threats for military information systems, the presence of malicious code within Commercial Off-the-Shelf (COTS) applications has been identified as a major risk that has not received a lot of attention. Like a virus that has infiltrated an information system during an electronic information exchange, malicious code integrated into a commercial application could remain undetected and present a major risk for the safety of information within a military system. In this paper techniques to detect malicious code within commercial applications are reviewed. Emphasis is placed upon the certifying compiler, which enforces a formal security specification while compiling the source code. This emerging technology offers the most comprehensive and sustainable approach for large applications and for the periodic certification of upgrades.
Author
Compilers; Information Systems; Risk; Commercialization; Computer Program Integrity

20010019332 Defence Research Establishment Valcartier, Val Belair, Quebec Canada
DYNAMIC DETECTION OF MALICIOUS CODE IN COTS SOFTWARE
Salois, Martin, Defence Research Establishment Valcartier, Canada; Charpentier, Robert, Defence Research Establishment Valcartier, Canada; Commercial Off-the-Shelf Products in Defence Applications 'The Ruthless Pursuit of COTS'; December 2000, pp. 16-1 - 16-13; In English; See also 20010019317
Report No.(s): ISBN 92-837-1049-5; Copyright Waived; Avail: CASI; A03, Hardcopy

Commercial Off-the-Shelf (COTS) components are very attractive because they can substantially reduce development time and cost, but they pose significant security risks (e.g. backdoors, Trojan horses, time bombs, etc.). These types of attack are not detected by standard virus detection utilities, which are essentially the only commercially available tools that work directly on binaries. This paper presents a dynamic approach that intends to address this

problem. The complexity of a real time-bomb attack that disables a program after a fixed period of time is shown. Building on this example, a method that works at the binary level and that could be used to facilitate the study of other time bombs, and hopefully of all types of malicious actions, is presented. This is the first step toward a fully automated tool to detect malicious actions in all their forms. The method, which monitors processor instructions directly, is currently intended specifically for Windows NT running on an Intel processor. It could easily be extended to other platforms. This paper also discusses the possibility of using dynamic analysis techniques to overcome the inadequacy of the static methods. Finally, a brief survey is presented of commercial tools that attempt to address this issue, considering where these products are today and what is needed to obtain a credible sense of security, as opposed to the often false sense offered by some commercial tools.
Author
Computer Programs; Risk; Security; Commercialization; Evaluation

20010019336 Lotus Development Corp., Paris, France
LOTUS WHITE PAPER ON COTS FOR MILITARY CRISIS APPLICATIONS
Fournery, Patrick, Lotus Development Corp., France; Sorensen, Uffe, Lotus Development Corp., France; Commercial Off-the-Shelf Products in Defence Applications 'The Ruthless Pursuit of COTS'; December 2000, pp. 20-1 - 20-4; In English; See also 20010019317
Report No.(s): ISBN 92-837-1049-5; Copyright Waived; Avail: CASI; A01, Hardcopy

As businesses evolve to e-businesses, it is interesting to observe how the civilian requirements related to Commercial Off-the-Shelf (COTS) software increasingly resemble the military crisis-mode requirements in terms of continuous operation (100% availability), vast scalability (Internet community), absolute reliability (transactional integrity), total security (numerous 'enemies' with malicious intent in a 1B user wired community), flexible and manageable interoperability (alliances, mergers and acquisitions must be almost instantaneous and fully controlled). As COTS software vendors satisfy these civilian requirements, it will eventually facilitate military use. Inadequate software will naturally be supplanted in the marketplace by capable technologies.
Author
Reliability; Security; Technology Utilization; Commercialization; Computer Programs

20010028488 R-Tec, Rolling Hills Estates, CA USA
TUTORIAL ON REPAIR SOFTWARE
Ratwani, Mohan M., R-Tec, USA; Aging Aircraft Fleets: Structural and Other Subsystem Aspects; March 2001, pp. 13-1 - 13-11; In English; See also 20010028476; Original contains color illustrations; Copyright Waived; Avail: CASI; A03, Hardcopy

Throughout the world military and commercial aircraft fleet are being used beyond their original design life. This is primarily due to the reduction in the budget for procurement of new systems and ever increasing cost of acquiring new aircraft. This has resulted in paying more attention to enhancing life of aircraft structures and at the same time maintaining the safety of flight. improved life enhancement techniques and repair concept are being developed to keep maintenance cost low, reduce down time of aircraft for repairs, reduce inspection requirements without jeopardizing the safety of aircraft structures. To reduce the down time of aircraft for repairs and perform more reliable durability and damage tolerance analyses, a number of software programs have been developed. These software programs are user Friendly and a user does not have to be an expert in the repair technology or durability and damage tolerance analyses. For most of these programs basic knowledge of stress analyses, fatigue and fracture mechanics is required. This tutorial discusses some of these programs, and steps involved in the analyses of repairs to assure safety of flight.
Derived from text
Stress Analysis; Fatigue (Materials); Aircraft Structures; Damage; Fracture Mechanics; Computer Programs

20010033269 Research and Technology Organization, Human Factors and Medicine Panel, Neuilly-sur-Seine, France
WHAT IS ESSENTIAL FOR VIRTUAL REALITY SYSTEMS TO MEET MILITARY HUMAN PERFORMANCE GOALS? *[LES CARACTERISTIQUES ESSENTIELLES DES SYSTEMES VR POUR ATTEINDRE LES OBJECTIFS MILITAIRES EN MATIERE DE PERFORMANCES HUMAINES]*
What is Essential for Virtual Reality Systems to Meet Military Human Performance Goals?; March 2001; 172p; In English; 13-15 Apr. 2000, The Hague, Netherlands; See also 20010033270 through 20010033286
Report No.(s): RTO-MP-058; AC/323(HFM-058)TP/30; ISBN 92-837-1057-6; Copyright Waived; Avail: CASI; A08, Hardcopy; A02, Microfiche

This workshop aimed to identify the functional requirements of potential military applications of Virtual Reality (VR) technology, to report the state-of-the-art and projected capabilities of VR technologies, and to propose future research requirements and directions for military applications. During the workshop discussions, forty participants from military organisations, academia and industry put forward their opinions on the significant bottlenecks and opportunities in the development of military VR applications. Presentations discussed visual, haptic, auditory and motion feedback, navigation interfaces, and scenario generation, modelling software and rendering hardware. VR research transition opportunities include the domains of training, planning & mission rehearsal, simulation supported operation, remotely operated systems and product design. Critical bottlenecks are a lack of natural interfaces, a lack of technology standardisation and a lack of behavioural models and team interaction tools in VR. In general, better co-ordination between military organisations, industry and academia is necessary in order to identify gaps in current knowledge and to co-ordinate research. Suggestions for closing gaps are included.
Derived from text
Functional Design Specifications; Systems Engineering; Virtual Reality; Human-Computer Interface; Computerized Simulation; Military Technology; Technology Assessment; Computer Programs

20010033271 Systematic Software Engineering A/S, Aabyhoj, Denmark
MISSION DEBRIEFING SYSTEM
Johansen, Birger I., Systematic Software Engineering A/S, Denmark; Fredborg, Bo, Systematic Software Engineering A/S, Denmark; What is Essential for Virtual Reality Systems to Meet Military Human Performance Goals?; March 2001, pp. 2-1 - 2-7; In English; See also 20010033269; Copyright Waived; Avail: CASI; A02, Hardcopy; A02, Microfiche

Systematic has developed a debriefing system for aircraft crews to improve their skills based on experiences from completed missions. The system is developed on Commercial Off The Shelf (COTS) software and on a PC. The panel should see this input as a portable. low-cost Virtual Reality (VR) training system for aircraft crews. The benefit of the portability is that the system can be used anywhere the unit is deployed and by any crewmember.
Author
Virtual Reality; Computerized Simulation; Environment Simulation; Flight Simulation; Low Cost; Training Simulators; Flight Training; Flight Crews

20010033272 Delegation Generale de l'Armement, Estblissment Technique d'Angers, Montreuil Juigne, France
MINE CLEARANCE IN A VIRTUAL ENVIRONMENT
Todeschini, Laurent, Delegation Generale de l'Armement, France; Pasquier, Therese, Delegation Generale de l'Armement, France; Hue, Pascal, Delegation Generale de l'Armement, France; Gorzerino, Paul, Delegation Generale de l'Armement, France; What is Essential for Virtual Reality Systems to Meet Military Human Performance Goals?; March 2001, pp. 3-1 - 3-7; In English; See also 20010033269; Copyright Waived; Avail: CASI; A02, Hardcopy; A02, Microfiche

At the same moment as France completed destruction of its stock of anti-personnel mines (21/12/99) in accordance with the 1998 Ottawa Agreement, in more than 60 countries there were 100 million live, buried 'permanent sentinel' mines continuing to mutilate the inhabitants of mine-infested regions, most of the wounded being children (600.000 people affected over 20 years, one person killed every 20 minutes by these devices designed to terrorize civil populations during the war, whose effects persist for a long time afterwards). Paradoxically, confronted by the sophisticated manufacturing techniques of these 'cowardly weapons', French sappers use a rudimentary mine clearance technique to render zones viable for the civil population. With the aid of a bayonet-type tool, the operator

probes the ground until he hits a suspect device. This task is carried out blind and one of the problems is identifying the presence of a mine and distinguishing it from a false alarm. This technique demanding 100% results, based on the skill and experience of the mine disposal team, is taught by the Minex Centre of the Applied Engineering Applications College. The Human Factors division of ETAS (Etablissement Technique d'Angers), a part of the DGA, has built and tested version 1 of a demonstrator and virtual environment for teaching this technique. One group under training now has been able to distinguish the methods for discriminating shapes after several contacts of the probe with the mine. In its version 2 (addition of force feedback), this demonstrator has become a genuine teaching tool for mine clearance strategy, enabling the instructor to validate the relevance of the students' probing, to minimize the amount of probing and therefore to increase the reliability of the decisions during an actual operation. In due course, this tool will also enable the technique to be taught to civilian populations and thus accelerate the process of decontamination which still takes a long time, costs a lot of money and, especially, costs lives. Technology development is already enabling us to consider version 3, a portable system which uses mathematical analysis of the probing geometry during real operations, and by comparison with a database, offers genuinely enhanced assistance to making decisions and taking action.
Author
Mines (Excavations); Clearances; Virtual Reality; Environment Simulation; Computerized Simulation; Motion Simulation

20010033273 Army Research Inst., Orlando, FL USA
ACQUIRING REAL WORLD SPATIAL SKILLS IN A VIRTUAL WORLD
Witmer, Bob G., Army Research Inst., USA; Knerr, Bruce W., Army Research Inst., USA; Sadowski, Wallace J., Jr., Army Research Inst., USA; What is Essential for Virtual Reality Systems to Meet Military Human Performance Goals?; March 2001, pp. 4-1 - 4-7; In English; See also 20010033269; Copyright Waived; Avail: CASI; A02, Hardcopy; A02, Microfiche

In rehearsing specific missions. soldiers frequently must learn about spaces to which they have no direct access. Virtual Environments (VE) representing those spaces can be constructed and used to rehearse the missions, but how do we ensure their effectiveness? The US Army Research Institute was among the first to demonstrate that spatial knowledge acquired in a virtual model of a building transferred to the real world. While route knowledge was readily acquired in a VE, configuration knowledge (distance and direction to locations not in the line-of-sight) was not. Spatial learning in the VE was hampered not only by disorientation resulting from a narrow FOV and multiple collisions with walls, but also by participants' inability to accurately estimate distances in VEs. Poor distance estimation in VE was linked to the reduced VE FOV and to verbal report procedures for making the estimates. Some improvement in distance estimates was obtained by adding auditory compensatory cues for distance and by using the non-visually locomotion technique for obtaining distance estimates. Armed with knowledge that some VE characteristics adversely affect distance estimation and configuration learning, we conducted research to determine if unique capabilities of VEs could compensate for those characteristics. We developed three VE navigation training aids: local and global orientation cues, aerial views. and division of the VE into distinctive themed quadrants. The aids were not provided when testing configuration knowledge. Training included a guided tour, free exploration of the VE and searching for designated rooms Configuration knowledge tests included a shortest route test, a pointing task, and a map construction task. An aerial view was the most effective navigation aid, though its effectiveness depended on how it was used. Those participants who used aerial views to organize the VE and learn its layout during free exploration performed quite well, while participants who used it as a crutch to locate a particular destination performed worse than those without an aerial view. To ensure that VEs train effectively, we must recognize VEs deficiencies, compensate for deficiencies whenever possible. and exploit VEs unique training capabilities.
Author
Virtual Reality; Environment Simulation; Computerized Simulation; Three Dimensional Models

20010033274 Bundesamt fuer Wehrtechnik und Beschaffung, Koblenz, Germany
ADVANCED AIR DEFENSE TRAINING SIMULATION SYSTEM (AADTSS): VIRTUAL REALITY IS REALITY IN GERMAN AIR-FORCE TRAINING
Reichert, M., Bundesamt fuer Wehrtechnik und Beschaffung, Germany; What is Essential for Virtual Reality Systems to Meet Military Human Performance Goals?; March 2001, pp. 5-1; In English; See also 20010033269; Copyright Waived; Avail: CASI; A01, Hardcopy; A02, Microfiche

This article describes the Advanced Air Defense Training Simulation System (AADTSS) and explains the reasons why it was realized with virtual reality technology.
Derived from text
Air Defense; Training Simulators; Virtual Reality; Computerized Simulation; Environment Simulation

20010033275 Naval Air Warfare Center, Training Systems Div., Orlando, FL USA
WHAT IS ESSENTIAL FOR VIRTUAL REALITY TO MEET MILITARY PERFORMANCE GOALS? PERFORMANCE MEASUREMENT IN VR
Patrey, Jim, Naval Air Warfare Center, USA; Breaux, Robert, Naval Air Warfare Center, USA; Mead, Andrew, Naval Air Warfare Center, USA; Sheldon, Elizabeth, Naval Air Warfare Center, USA; What is Essential for Virtual Reality Systems to Meet Military Human Performance Goals?; March 2001, pp. 6-1 - 6-5; In English; See also 20010033269; Copyright Waived; Avail: CASI; A01, Hardcopy; A02, Microfiche

One of the unique attributes and potentially greatest assets of virtual environments is the unique ability to comprehensively measure human performance. In the real environment, measuring human behaviors is usually, though not always. feasible and typically extremely effort intensive and cost-prohibitive. Similarly, there is substantial environmental variability that can have pervasive effects on human performance but is beyond any feasible, economic data capture. Virtual environments instill the capability for comprehensively monitoring both user inputs and interactions and the environment (as well as control the virtual environment and thereby eliminating confounding variables with precision beyond that of real environment lab research).
Derived from text
Virtual Reality; Computerized Simulation; Environment Simulation; Human-Computer Interface; Training Simulators

20010033276 Institute for Human Factors TNO, Soesterberg, Netherlands
APPROPRIATE USE OF VIRTUAL ENVIRONMENTS TO MINIMIZE MOTION SICKNESS
Bles, Willem, Institute for Human Factors TNO, Netherlands; Wertheim, Alexander H., Institute for Human Factors TNO, Netherlands; What is Essential for Virtual Reality Systems to Meet Military Human Performance Goals?; March 2001, pp. 7-1 - 7-9; In English; See also 20010033269; Copyright Waived; Avail: CASI; A02, Hardcopy; A02, Microfiche

With the current fast rate of' technological developments and the high requirements for training with sophisticated apparatus, the military has become more and more involved in working with simulators. The term simulator' here means: a systems that has the potential to create sensations of passive or active self movement in a simulated environment. This definition of the term not only applies to the traditional flight simulators. both with and without a Moving base, but also to Virtual Environments (VE) set-ups implemented in Head Mounted Display (HMD) systems, which no doubt will become part of future flight training programs.
Derived from text
Virtual Reality; Computerized Simulation; Environment Simulation; Motion Simulation; Motion Simulators; Motion Sickness

20010033277 Aerospatiale, Suresnes, France
SIMULATING HAPTIC INFORMATION WITH HAPTIC ILLUSIONS IN VIRTUAL ENVIRONMENTS
Lecuyer, Anatole, Aerospatiale, France; Coquillart, Sabine, Institut National de Recherche d'Informatique et d'Automatique, France; Coiffet, Philippe, Centre National de la Recherche Scientifique, France; What is Essential for Virtual Reality Systems to Meet Military

Human Performance Goals?; March 2001, pp. 9-1 - 9-6; In English; See also 20010033269; Copyright Waived; Avail: CASI; A02, Hardcopy; A02, Microfiche

This paper presents a set of experiments in which a human user feels haptic sensations. These sensations are in fact haptic illusions. generated by a visual effect. Then. these haptic illusions are described and analysed. These haptic illusions were generated by the use of a pseudo-haptic feedback system. It is a system combining an isometric input device and visual feedback. The experimental apparatus did not use any force feedback interface. The paper addresses the role of action in the perception loop -- subjects felt a reactive force corresponding to their own sensory-motor command. In addition. subjects had to 'participate' in the illusion process by choosing the cognitive strategy, which led to the illusion. In the future, the use of the concept of illusion might improve or simplify VR simulations and pave the way to a better understanding of human perception.

Author

Touch; Illusions; Feedback; Virtual Reality; Environment Simulation; Computerized Simulation

20010033278 Institute for Human Factors TNO, Soesterberg, Netherlands

TACTILE DISPLAYS IN VIRTUAL ENVIRONMENTS

vanErp, Jan B. F., Institute for Human Factors TNO, Netherlands; What is Essential for Virtual Reality Systems to Meet Military Human Performance Goals?; March 2001, pp. 10-1 - 10-7; In English; See also 20010033269; Copyright Waived; Avail: CASI; A02, Hardcopy; A02, Microfiche

Virtual Reality (VR) technology allows the user to perceive and experience sensory contact with a non-physical world. A complete Virtual Environment (VE) will provide this contact in all sensory modalities. However. even state-of-the-art VEs are often restricted to the visual modality only. The use of the tactile modality might not only result in an increased immersion, but may also enhance performance. An example that will be discussed in this paper is the use of the tactile channel to support the processing of degraded visual information. The lack of a wide visual field of view in VEs excludes the use of peripheral vision and may therefore degrade navigation, orientation, motion perception. and object detection. However, tactile actuators applied to the torso have a 360' horizontal 'field of touch', and may be suited to present navigation information.

Author

Virtual Reality; Display Devices; Visual Fields; Field Of View

20010033279 Technische Univ., Inst. for Flight Mechanics and Control, Darmstadt, Germany

VIRTUAL COCKPIT SIMULATION FOR PILOT TRAINING

Doerr, Kai-Uwe, Technische Univ., Germany; Schiefele, Jens, Technische Univ., Germany; Kubbat, W., Technische Univ., Germany; What is Essential for Virtual Reality Systems to Meet Military Human Performance Goals?; March 2001, pp. 11-1 - 11-7; In English; See also 20010033269; Copyright Waived; Avail: CASI; A02, Hardcopy; A02, Microfiche

For some of today's simulations very expensive, heavy. and large equipment is needed. Examples are driving. shipping, and flight simulators with huge and expensive visual and motion systems. In order to reduce cost, immersive 'Virtual Simulation' becomes very attractive. Head Mounted Displays (HMD) or CAVEs (Computer Animated Virtual Environments), Datagloves. and cheap 'Seating Bucks' are used to generate a stereoscopic virtual environment (VE) for the trainee. IVS enhances training quality and quantity for classroom-teaching and Computer Based Training (CBT). It allows to visualize and animate teaching material in a more natural stereoscopic environment. Data of before unseen complexity can be revealed and complex models easily visualized. For the first time. the trainee himself can interact with a Data-Glove in the environment and collect cockpit experience long before his maiden flight. CAVEs and Immersive Projection Screens enable-group training' to collect personal and shared experience while further enhancing training quality. With increasing maturity of VR-gear IVS will allow to generate new training metaphors for immersive flight simulation. This might include the enhancement or partial replacement of conventional flight simulators by IVS.

Author

Flight Simulation; Cockpits; Pilot Training; Virtual Properties; Display Devices; Education

20010033280 Institute for Human Factors TNO, Soesterberg, Netherlands

UAV OPERATIONS USING VIRTUAL ENVIRONMENTS

vanErp, Jan B. F., Institute for Human Factors TNO, Netherlands; vanBreda, Leo, Institute for Human Factors TNO, Netherlands; What is Essential for Virtual Reality Systems to Meet Military Human Performance Goals?; March 2001, pp. 13-1 - 13-7; In English; See also 20010033269; Copyright Waived; Avail: CASI; A02, Hardcopy; A02, Microfiche

In virtual environments (VE), the limited field of view, the lack of information on viewing direction, and possible transmission delays may be considered as potential problems in developing and maintaining a good sense of situation awareness. Enabling unmanned air vehicle (UAV) operators to use high quality (proprioceptive) information on (changes in) viewing direction by introducing a head-slaved camera system with head-slaved display (HMD) may improve situation awareness, compared to using a joystick and a fixed monitor. However, HMDs may degrade comfort and the dynamics of head movements. Furthermore, time delays and zoomed-in images induce a non-steady presentation of the environment, and may impede adequate mapping of spatial information. This paper reports an exploratory study into the applicability of a head-slaved camera system in unmanned platform applications. To overcome the possible drawbacks of HMDs we compared an HMD with a head-slaved dome projection in a simulator experiment. To overcome the possible drawbacks of transmission delay, we introduced a new method to compensate for the spatial distortions. This technique, called delay-handling, preserves the correct spatial relation between the viewing direction of the camera and operator by presenting incoming images in the camera viewing direction, and not in the actual viewing direction of the operator. The experimental results showed that delay-handling is successful in supporting the perception of correct spatial relations, i.e.. it improves situation awareness. No differences in task performance were found between the actual HMD and the dome projection.

Author

Field Of View; Human Performance; Virtual Reality; Proprioception

20010033281 Valencia Univ., Inst. of Robotics, Spain

THE DANGEROUS VIRTUAL BUILDING, AN EXAMPLE OF THE USE OF VIRTUAL REALITY FOR TRAINING IN SAFETY PROCEDURES

Lozano, Miguel, Valencia Univ., Spain; Fernandez, Marcos, Valencia Univ., Spain; Casillas, Joaquin, Valencia Univ., Spain; Fernandez, Javier, Valencia Univ., Spain; Romero, Cristina, Valencia Univ., Spain; What is Essential for Virtual Reality Systems to Meet Military Human Performance Goals?; March 2001, pp. 15-1 - 15-6; In English; See also 20010033269; Copyright Waived; Avail: CASI; A02, Hardcopy; A02, Microfiche

There is an ancient proverb that says 'Tell me and I will 'forget. Show me and I may remember involve me and I will learn '. This has been the main principle behind the big raising of immersive technologies in the field of training and education. Here we explain our experience in using this kind of technology in the area of work risk and incident prevention. The high accident rate suffered by the construction sector has been one of the reasons that have moved us to develop the system that this article describes. The objective of the system is the training, of the operator in safety procedures on the job. For this reason a VR system has been created that on the one hand reproduces a similar environment to the one experienced by the operator in real life, and on the other hand it provides for a number of operations to be completed. These operations which are very usual for the worker in real life imply a risk that must be understood by the worker, e.g. walking around the construction trenches carrying some type of load could cause a loosening of the ground resulting in death. For the complete training of the worker. the virtual environment contains the three fundamental phases of the construction of a building. Besides all of the general tools of the job may or may not have a safety component. So the number of dangerous operations that the system provides for and monitors are encountered in real life (working on a scaffolding, in trenches, on roofs, on the various floors, crashes, falls. overloads, etc.) By means of training and learning about the risks involved in the operations (from the most simple) you will obtain the best preparation in the sector, reducing therefore the rate mentioned above. Using the system the worker is really involved in the task, and is able to understand the real risk that the task carries out, because he is in front of a screen that shows the object in its

actual size and he has to mike the proper decision. The system do not intent to train him or her in the skills of the task but in the safety way to proceed in its development. This is a case that can be port to other military or civil areas where not only are important the skills but also is necessary to observe a methodology that ensures a safety performance. We point out also in this paper how is possible using low-cost equipment to produce a good degree of immersive system. This is an important point in order to extend the use of those systems to such a sector or when the number of subjects to be involved in the training process make necessary to use a elevate number of simulation systems.
Author
Virtual Reality; Education; Safety; Construction; Risk

20010033282 FGAN, Dept. Ergonomics and Information Systems, Wachtberg-Werthhoven, Germany
VISUALISATION OF GEOGRAPHIC DATA IN VIRTUAL ENVIRONMENTS
Alexander, Thomas, FGAN, Germany; What is Essential for Virtual Reality Systems to Meet Military Human Performance Goals?; March 2001, pp. 16-1 - 16-9; In English; See also 20010033269; Copyright Waived; Avail: CASI; A02, Hardcopy; A02, Microfiche

Virtual Environments (VE) are characterised as a computer-based generation of scenes of abstract or realistic environments, which can be perceived consistently. The use of VE is very promising in several areas. especially when visualisation of complex data in a realistic and clearly understandable way is needed. For military applications VE technology has potential in the area of research and development. training, mission support and mission rehearsal. A further application is use in Command & Control (C2)systems due to upcoming demands in this area. In future battlespace scenarios huge amounts of highly dynamic information will be available due to the technical development of sensor, communication and information systems. Therefore advanced techniques for supporting the military commander and displaying complex tactical situation data in a clearly understandable way have to be developed and evaluated. In this connection a concept for pre-processing and visualising incoming tactical data and three-dimensional geographical data has been developed. This 'Electronic Sandtable (ELSA)'. as described in this paper, uses VE technology. The ELSA facilitates a plastic stereoscopic visualisation of three-dimensional data. It has been designed to simulate a sandtable as commonly used by the Armed Forces for tactical education and training. Therefore the visualisation of digital geographic data (elevation (DTED) and feature (DFAD) data) is necessary. This paper focuses on the stereoscopic visualisation of geographic data. Therefore different stereoscopic projection models are described and compared to each other. For the Electronic Sandtable a model with a window projection was chosen and implemented. The baseline concept and first results of this implementation are referred to in this paper.
Author
Virtual Reality; Geography; Command And Control; Computer Techniques; Digital Data

20010033283 Gerhard-Mercator Univ., Duisburg, Germany
ACQUIRING DISTANCE KNOWLEDGE IN VIRTUAL ENVIRONMENTS
Heineken, Edgar, Gerhard-Mercator Univ., Germany; Schulte, Frank P., Gerhard-Mercator Univ., Germany; What is Essential for Virtual Reality Systems to Meet Military Human Performance Goals?; March 2001, pp. 17-1 - 17-5; In English; See also 20010033269; Copyright Waived; Avail: CASI; A01, Hardcopy; A02, Microfiche

Experimental results on the perception and cognition of distances in virtual environments are reported. These results show differences in the accuracy of distance perception depending on whether they are presented in desktop- or HMD-VR. In addition. they show that distance cognition in virtual environments is based on online-judgements (perception based) or on inferential judgements (memory based) depending on the subject's goal when navigating through the environment. Without an explicit goal to learn distances (incidental learning condition) the estimated length of routes in a virtual environment is inferred by the number of features (feature-accumulation-hypothesis experienced on the respective route, just like in natural environments.
Author
Virtual Reality; Distance; Estimating; Navigation; Space Perception

20010033285 Industrieanlagen-Betriebsgesellschaft m.b.H., Ottobrunn, Germany
EDUCATIONAL CONDITIONS FOR SUCCESSFUL TRAINING WITH VIRTUAL REALITY TECHNOLOGIES
vonBaeyer, Alexander, Industrieanlagen-Betriebsgesellschaft m.b.H., Germany; Sommer, Hartmut, Industrieanlagen-Betriebsgesellschaft m.b.H., Germany; What is Essential for Virtual Reality Systems to Meet Military Human Performance Goals?; March 2001, pp. 19-1 - 19-3; In English; See also 20010033269; Copyright Waived; Avail: CASI; A01, Hardcopy; A02, Microfiche

The paper focuses on those pedagogical conditions, which should be met, in order to assure successful training using virtual reality (VR) technologies. Therefore, neither new technical inventions nor large scale technical experiments are the issue of this paper. Instead a systematic catalogue of pedagogical questions will be proposed, which should be answered. before virtual reality is planned for training purposes. The pedagogical catalogue is derived from the basics of educational psychology and media didactics. It comprises: 1) a taxonomy of learning objects, which are most suitable for virtual reality; 2) an analysis of training strategies and methods, as to how well they are suited for training in an almost entirely synthetic environment; 3) an analysis of the transfer of training. when virtual reality is the major training medium; and 4) rules and basic cost data, which may help to conduct cost effectiveness analyses.
Author
Virtual Reality; Education; Transfer Of Training; Psychology

20010033286 Army Simulation Training, and Instrumentation Command, Orlando, FL USA
ENTERTAINMENT TECHNOLOGY AND MILITARY VIRTUAL ENVIRONMENTS
Macedonia, Michael R., Army Simulation Training, and Instrumentation Command, USA; Rosenbloom, Paul, University of Southern California, USA; What is Essential for Virtual Reality Systems to Meet Military Human Performance Goals?; March 2001, pp. 20-1 - 20-6; In English; See also 20010033269; Copyright Waived; Avail: CASI; A02, Hardcopy; A02, Microfiche

Bran Ferren makes a compelling argument that the Entertainment Industry is driving the technology advances needed for military virtual reality system:. Moreover. the military virtual environment community may actually be falling behind its civilian counterparts by ignoring the rapid changes going on in entertainment computing. These advances include low cost computer graphics. agent technology, and the use of 3D audio. In this paper we will explore some of the reasons how and why the Entertainment Industry is advancing the state of virtual reality (VR). We will also look at the current problems of military simulation. particularly its lack of story and emotion. Finally, this paper examines how the US Army is trying to address these issues with the establishment of the Institute for Creative Technology (ICT)
Author
Technology Utilization; Computer Graphics; Virtual Reality

20010047053 Reliable Software Technologies Corp., Dulles, VA USA
ASSESSING SURVIVABILITY USING SOFTWARE FAULT INJECTION
Voas, Jeffrey, Reliable Software Technologies Corp., USA; New Information Processing Techniques for Military Systems; April 2001, pp. 11-1 - 11-10; In English; See also 20010047042; Copyright Waived; Avail: CASI; A02, Hardcopy

In this paper, we present an approach and experimental results from using software fault injection to assess information survivability. We define information survivability to mean the ability of an information system to continue to operate in the presence of faults, anomalous system behavior, or malicious attack. In the past, finding and removing software flaws has traditionally been the realm of software testing. Software testing has largely concerned itself with ensuring that software behaves correctly - an intractable problem for any non-trivial piece of software. In this paper, we present 'off-nominal' testing techniques, which are not concerned with the correctness of the software, but with the survivability of the software in the face of anomalous events and malicious attack. Where software testing is focused on ensuring that the software computes the specified function correctly, we are concerned that the software

continues to operate in the presence of faults, unusual system events or malicious attacks.
Author
Computer Programs; Injection; Software Reliability; Program Verification (Computers)

20010047069 Defence Evaluation Research Agency, Malvern, UK
INFORMATION VISUALISATION IN BATTLE MANAGEMENT
Varga, Margaret, Defence Evaluation Research Agency, UK; McQueen, Steve, Defence Evaluation Research Agency, UK; Rossi, Adrian, Defence Evaluation Research Agency, UK; New Information Processing Techniques for Military Systems; April 2001, pp. 26-1 - 26-7; In English; See also 20010047042; Original contains color illustrations; Copyright Waived; Avail: CASI; A02, Hardcopy

Visualisation is often thought of as simply the use of computer systems to display processed data graphically, often in a rather colourful and complex manner. More generally, however, visualisation is the human's capacity to utilize effectively and efficiently the output from a computer in order to understand data. Military operations today depend heavily on the C(sup 4)ISR (Command Control, Communications, Computing, Intelligence, Surveillance and Reconnaissance) framework. Unfortunately many military systems make it difficult for users to develop a useful understanding of the information relevant to immediate requirements which is contained within the massive amount of data that flows from the various intelligence sources. The users may not be able to use the systems to extract the information from the data, or they may not be able to create displays that allow them to see what they need. Potential information sources may be ignored, or not well used, because techniques for extracting information are deficient. As a consequence, users of many current systems discard much data unassessed. Strategic and tactical actions, simulation and training are all seen to be significantly less efficient than they might be because commanders are not able to access, assimilate and exploit all the available information. New technologies and data sources now envisaged will require radically improved ways for allowing users to interact with data. Interaction is critical, but at present information is usually presented to commander-,, analysts and executives as a passive situation display. Effective visualisation requires the users to interact closely with the visual, auditory and perhaps haptic displays. This paper describes the UK Master Battle Planner (MBP). The MBP is an Air Tasking Order planning tool, which aims to provide an adaptive, decision-centered, visualisation environment for UK Joint force commanders. The MBP's developing mission assessment component is also described.
Author
Military Operations; Telecommunication; Command And Control; Information Systems

20010047071 Office of Naval Research, Arlington, VA USA
A FRAMEWORK FOR MULTIDIMENSIONAL INFORMATION PRESENTATION USING VIRTUAL ENVIRONMENTS
Matzke, Sarah Monique, Office of Naval Research, USA; Schmorrow, Dylan D., Office of Naval Research, USA; New Information Processing Techniques for Military Systems; April 2001, pp. 28-1 - 28-5; In English; See also 20010047042; Copyright Waived; Avail: CASI; A01, Hardcopy

A variety of Virtual Environment (VE) systems exist today and there are as many terms to them. Synthetic environments, virtual reality (VR), and VEs, to name a few, all refer to a simulation of some operational environment. The gamut of VEs runs anywhere from desktop displays to fully immersive and interactive scenes. What these systems share is the need to capture, process, and present data. Presented effectively, the information can enable a user to make timely and informed decisions. This paper will provide some examples of current VE technology and present a framework for VE systems. The paper will also address some of the future directions and challenges facing the evolution of VE technology.
Author
Display Devices; Simulation; Virtual Reality

20010047072 Naval Research Lab., Washington, DC USA
DISTRIBUTED COLLABORATIVE VIRTUAL REALITY FRAMEWORK FOR SYSTEM PROTOTYPING AND TRAINING
Guleyupoglu, Suleyman, Naval Research Lab., USA; Ng, Henry, Naval Research Lab., USA; New Information Processing Techniques for Military Systems; April 2001, pp. 29-1 - 29-8; In English; See also 20010047042; Original contains color illustrations; Copyright Waived; Avail: CASI; A02, Hardcopy

The significant impact Information Technology has made in the lives of most people in the last decade or two is undeniable. Coupled with other enabling technologies, many tasks get accomplished more efficiently and reliably nowadays. However, there are instances where the adoption of these technologies takes longer for variety of reasons. System prototyping and training of war fighters has been an area where enabling technologies can be better utilized. One of the keys to the success of military operations with the least amount of casualties is a well-trained group of people fighting the war. It is also essential that they are well accustomed to the environment in which they operate and comfortable with it. To achieve this, live training would be ideal in almost all cases except where it would pose a significant safety risk. This, of course, is not possible in reality as the resources available for training is limited in the real world. In this paper, we address the use of enabling technologies in the military and describe a framework that takes advantage of several state-of-the-art technologies to perform combat system design, evaluation and training. The framework uses virtual reality and distributed computing technologies to provide users (trainees, trainers, or combat system designers) an immersive environment to interact with the combat system and the other users. The framework allows participants to collaborate on the same mission or activity in the virtual environment without the need to be at the same geographical location. There are numerous benefits to systems based on this framework. It is possible to bring together participants into the same virtual environment as opposed to doing this in the physical world that may be costly and sometimes difficult logistically. The cost of training is significantly cheaper since the initial cost and maintenance of computer equipment is usually less than the cost of real combat systems. The framework allows new weapon systems, for example a combat information center, to be built virtually so that users can conduct a walk-through and make suggestions on the design of the system. In other words, the end users can actively participate in the early design phase of a new combat system.
Derived from text
Virtual Reality; Training Devices; Information Systems; Prototypes; Systems Engineering

20010072746 Research and Technology Organization, Modelling and Simulation Group, Neuilly-sur-Seine, France
THE SECOND NATO MODELLING AND SIMULATION CONFERENCE *[DEUXIEME CONFERENCE OTAN SUR LA MODELISATION ET LA SIMULATION]*
July 2001; 190p; In English; 24-26 Oct. 2000, Shrivenham, UK; See also 20010072747 through 20010072767; CD-ROM contains fulltext document in PDF or PowerPoint format; Original contains color illustrations
Report No.(s): RTO-MP-071; AC/323(NMSG-010)TP/1; ISBN 92-837-1069-X; Copyright Waived; Avail: CASI; C01, CD-ROM; A09, Hardcopy; A02, Microfiche

The conference presented a series of papers in plenary sessions that were designed to provide an overview of NATO Modelling and Simulation (M&S) current best practice, standards, interoperability and reuse. The Conference also provided information on NATO M&S policy, and new M&S activities within the Alliance.
Author
Conferences; Computerized Simulation; Environment Simulation; Models; Human Factors Engineering; Military Technology

20010072747 Research and Technology Organization, Neuilly-sur-Seine, France
TECHNICAL EVALUATION REPORT
Igarza, Jean-Louis, Research and Technology Organization, France; The Second NATO Modelling and Simulation Conference; July 2001, pp. T-1 - T-13; In English; See also 20010072746; Copyright Waived; Avail: CASI; A03, Hardcopy

At the turn of the century, NATO's roles are expanding (despite shrinking defence budgets) and Modelling and Simulation (M&S) is recognized as a key issue by the Alliance. Since the early nineties, the continuous evolution of the technology has demonstrated that M&S should be an unavoidable basis for the exercising and training activity, the setting of plans, the assessment of new doctrines and tactics, etc. The importance of M&S for NATO has been demonstrated by some initiatives, starting around 1995, when ad-hoc

working groups, conferences, workshops, and demonstrations have been organized by Alliance organizations at all levels. From those initiatives, many useful reports have been produced showing a growing interest for this subject. But, the most significant event occurred when, by the end of 1998, the NAC with the support of both the CNAD and the MC, took the option to set up a new and dedicated organization within the Research and Technology Organization (RTO), recognising de facto the underlying technical character of this activity. This new M&S organization started its activity within the RTO in the middle of 1999. However, the 2000 NATO M&S conference is already the second M&S conference that has been organized. The 2000 NATO Modelling and Simulation conference was hosted by the UK, in conjunction with the 3rd International Synthetic Environment conference and was held at The Royal Military College of Science in Schrivenham (England). More than twice the number of papers as slots were available were received by the conference Program Committee and selection of presentations appeared difficult. However, a high quality selection of papers covering a good cross-section of M&S activities were eventually selected by the Program Committee which were appreciated by some 180 people who attended the conference. The conference was organized in different sessions by a grouping of papers in well identified themes in order to facilitate and generate discussions on common concerns.
Author
Simulation; Models; Technology Utilization; Evaluation

20010072748 Ministry of Defence, SECO, London, UK
A STRATEGY FOR THE PROVISION OF INFRASTRUCTURE AND SERVICES IN SUPPORT OF SYNTHETIC ENVIRONMENTS
Henderson, J. M., Ministry of Defence, UK; Salmon, R. J., Defence Evaluation Research Agency, UK; The Second NATO Modelling and Simulation Conference; July 2001, pp. 1-1 - 1-9; In English; See also 20010072746; Copyright Waived; Avail: CASI; A02, Hardcopy

In recent years the role and potential of Synthetic Environments (SEs) to support Defense programs has expanded dramatically. This expansion is highlighting a number of issues which may, if they remain unresolved, prevent the full potential of SEs being realized and exploited. These issues center on the requirement that the provision of SE must be economical. This paper describes a study which was aimed at understanding these issues and developing a strategy and program of work to overcome them.
Author
Virtual Reality; Environment Simulators; Support Systems

20010072749 Defence and Civil Inst. of Environmental Medicine, Toronto, Ontario Canada
A R AND D STRATEGY FOR THE WAY AHEAD IN M AND S FOR THE CANADIAN AIR FORCE
Landolt, Jack P., Defence and Civil Inst. of Environmental Medicine, Canada; Evans, John R., Defence Research and Development Canada, Canada; The Second NATO Modelling and Simulation Conference; July 2001, pp. 4-1 - 4-6; In English; See also 20010072746; Copyright Waived; Avail: CASI; A02, Hardcopy

The capital-equipment program of the Canadian Department of National Defense (DND) is strongly focussed towards commercial-off-the-shelf purchases and the life extensions of existing systems through new technology insertions. This influences the way that DND mobilizes its resources for force development, life-cycle acquisition, and training when meeting capability requirements. The use of contemporary methods in modelling and simulation (M&S) is drawing increasing attention within DND as an important way of achieving cost-effective objectives in support of this type of capital equipment modernization process. Defence R&D Canada (DRDC), under the direction of Directorate Science and Technology Air (DSTA), recently completed a study on some long-term initiatives in research and development (R&D) in M&S that could aid Canadian air-force objectives in capability modernization for the delivery of air power. To date, air force M&S has been confined largely to the purchase of training simulators, and the development and use of operational-research modelling tools. This paper addresses R&D issues across all of the domains of M&S application that DRDC could undertake in meeting the different airforce capability requirements. These include force, doctrine and tactics development, acquisition, operation and support of equipment, and training.
Author
Research And Development; Cost Effectiveness; Models; Computerized Simulation

20010072750 Thomson Training and Simulation Ltd., Crawley, UK
EMERGING ISO STANDARDS FOR THE REPRESENTATION OF PHYSICAL ENVIRONMENTAL DATA
Cogman, Jack, Thomson Training and Simulation Ltd., UK; The Second NATO Modelling and Simulation Conference; July 2001, pp. 8-1 - 8-7; In English; See also 20010072746; Original contains color illustrations; Copyright Waived; Avail: CASI; A02, Hardcopy

In order for standards to be effective, they have to be developed by a consensus of the users. In the case of standards for the representation of physical environment data, the users are both Military and Civil and operate in a range of different domains, from modelling and simulation through to entertainment. The SEDRIS Organization has recognized the benefits of international, commercial based standards and has chosen to work with ISO/IEC to develop standards for environmental data representation and interchange. The work of an Industry/Government team has produced a robust environmental data interchange mechanism. The related technologies include a data representation model for the physical environment (terrain, ocean, atmosphere and space), a method for uniquely classifying and identifying the objects in that model and a spatial reference model to unambiguously specify locations. The task is to transpose this technology into International Standards. This paper reports on the standardization process that was selected for SEDRIS, the progress and timescale for the publication of the related ISO/IEC standards and the impact that the standardization process has had on the development of SEDRIS.
Author
Standardization; Environment Simulators; Data Management

20010072751 Royal Military Coll. of Science, Shrivenham, UK
THE USE OF DIS AND HLA FOR REAL-TIME, VIRTUAL SIMULATION: A DISCUSSION
Steel, Joseph, Royal Military Coll. of Science, UK; The Second NATO Modelling and Simulation Conference; July 2001, pp. 10-1 - 10-9; In English; See also 20010072746; Copyright Waived; Avail: CASI; A02, Hardcopy

The ability of simulation systems to exchange information is of paramount importance in a synthetic environment. Both Distributed Interactive Simulation (DIS) and the High Level Architecture (HLA) via the Run Time Infrastructure (RTI) facilitate this information exchange. However, they do so in very different ways. This paper compares and contrasts the two methods in their use in a real-time synthetic environment (SE) involving a number of virtual and constructive simulations. The paper is presented in the form of a conversation or debate between two system developers: one who believes that DIS is sufficient for the task at hand, while the other is a firm believer in HLA. The conversation is based upon the experiences of the two developers, in using their respective method for a synthetic environment incorporating a number of generic vehicle simulators and a semi-autonomous force generator. This conversation revolves around a number of issues that occur when using each of the two methods. These include the initial learning curve; ease of implementation; problems of interoperability between other systems within the SE and the facility for system re-use.
Author
Distributed Interactive Simulation; Information Transfer; Environment Simulation

20010072752 Federal Armed Forces Univ., Munich, Germany
NATO LONG TERM SCIENTIFIC STUDY (LTSS/51) ON HUMAN BEHAVIOUR REPRESENTATION
Dompke, Uwe K. J., Federal Armed Forces Univ., Germany; The Second NATO Modelling and Simulation Conference; July 2001, pp. 11-1 - 11-7; In English; See also 20010072746; Original contains color illustrations; Copyright Waived; Avail: CASI; A02, Hardcopy

NATO Long Term Scientific Studies (LTSS) are held to give a forecast on technological developments in specific areas with their impact on military operations and to give recommendations for future research activities. The paper will give an overview on the results of the LTSS for Human Behavior Representation. This includes a

definition of the term Human Behavior Representation as used by the study team, an overview on the state-of-the-art, a discussion of applications in NATO, and the technological forecast. The recommendations for future research activities as a result of the LTSS symposium will close the paper.
Author
Human Behavior; Technological Forecasting; Computerized Simulation

20010072753 Meteorological Office, Bracknell, UK
SYNTHETIC ENVIRONMENTS: THE MET. OFFICE APPROACH
Golding, B. W., Meteorological Office, UK; The Second NATO Modelling and Simulation Conference; July 2001, pp. 12-1 - 12-8; In English; See also 20010072746; Original contains color illustrations; Copyright Waived; Avail: CASI; A02, Hardcopy

Weather is critical to all military operations, whether on sea, in the air, or on land. While equipment development continually strives for an all-weather capability, and ideally for weather independence, these advances more often lead to a capability for operations in more marginal conditions, increasing, rather than decreasing, the need for weather guidance. For this reason, the paper has been structured to first describe some of the critical influences of weather on military operations, then to describe current Met. Office work in synthetic environments, and then to look at some other related requirements for weather information.
Author
Weather; Military Operations

20010072754 Army Simulation Training, and Instrumentation Command, Orlando, FL USA
DYNAMIC TERRAIN IN THE SYNTHETIC ENVIRONMENT
Simons, Rita, Army Simulation Training, and Instrumentation Command, USA; The Second NATO Modelling and Simulation Conference; July 2001, pp. 13-1 - 13-8; In English; See also 20010072746; Original contains color illustrations; Copyright Waived; Avail: CASI; A02, Hardcopy

Simulation has become the primary solution for training US Army soldiers in the use of real weapons systems. As such, the requirements for realism and greater fidelity are essential. An area lacking in achieving increased realism is the representation of Dynamic Terrain (real-time manipulation of the terrain). Command decisions and collective training by maneuver forces rely on terrain cues. The US Army Simulation, Training and Instrumentation Command (STRICOM) has sponsored research in this area since the early 1990s. Early efforts were limited by technology and did not meet expectations. However, in December 1998 STRICOM awarded a contract to explore and develop an approach for a low cost, PC based solution for dynamic terrain that has demonstrated strong potential in resolving this long-standing need. A follow-on contract was awarded in December 1999 to implement the approach and demonstrate the feasibility and effectiveness of the concept. The results of this follow-on contract will be demonstrated at the Interservice/Industry Training Systems and Education Conference (I/ITSEC) in Orlando, Florida from 27-30 Nov 2000. This paper describes the phase 1 and phase 2 efforts implementation of dynamic terrain into the synthetic environment using Distributed Interactive Simulation (DIS) and/or High Level Architecture (HLA) protocols, and a Synthetic Environment Data Representation and Interchange Specification (SEDRIS) Transmittal Format (STF) database.
Author
Training Simulators; Environment Simulation; Distributed Interactive Simulation; Terrain

20010072755 Defence Evaluation Research Agency, Simulation and Training, Land and Weapon Systems, Chertsey, UK
SYNTHETIC ENVIRONMENTS IN ADVANCED DISTRIBUTED LEARNING
Kelly, M., Defence Evaluation Research Agency, UK; Allen, J., Defence Evaluation Research Agency, UK; The Second NATO Modelling and Simulation Conference; July 2001, pp. 14-1 - 14-8; In English; See also 20010072746; Original contains color illustrations; Copyright Waived; Avail: CASI; A02, Hardcopy

This paper discusses the potential requirements to link modelling and simulation technology to the increasingly important training technology of Advanced Distributed Learning (ADL). ADL is the fastest growing training technology for intra and internet based training applications and is currently being investigated by DERA for delivering an Army wide Unit Based Training (UBT) capability. This UBT research program has highlighted the necessary links and benefits that must be made by ADL to the Synthetic Environment (SE) domain. There are a number of emerging discussion papers defining the requirements for ADL in military training, including a NATO Simulation and Modelling Initiative. These papers all identify the need to draw from a wide range of modelling and simulation technologies. An application on ADL, Unit Tactical Trainer (UTT), has been identified that it will benefit by employing existing SE technologies. Such technologies include synthetic forces (e.g., MoDSAF). This paper identifies where we can benefit from the advances being made in SE's, allowing an increased utilization of ADL.
Author
Training Devices; Computerized Simulation

20010072756 Royal Military Coll. of Science, Shrivenham, UK
THE USE OF VIRTUAL SIMULATION FOR DISMOUNTED INFANTRY TRAINING
Smith, J. D., Royal Military Coll. of Science, UK; Steel, J., Royal Military Coll. of Science, UK; The Second NATO Modelling and Simulation Conference; July 2001, pp. 15-1 - 15-9; In English; See also 20010072746; Copyright Waived; Avail: CASI; A02, Hardcopy

This paper discusses the use of Virtual Simulation and Synthetic Environments (SEs) for the training of the dismounted infantry (DI) soldier. The paper covers the needs and issues for this training and gives a series of examples of active research applications including improvements in terrain fidelity. The approaches for current Infantry training are outlined together with a broader review of other arms training. The development of virtual simulations/SEs as training media in all areas of military training is discussed. The limited examples of virtual simulation for DI is discussed, including the representation of DI in other simulations (e.g., the UK Combined Arms Tactical Trainer (CATT)). Current thinking on the important characteristics for virtual simulation for DI training is outlined including the user interface, terrain, graphics, weapon simulation, networking, CGF, and infrastructure. Within this the difficulties of providing adequate and useful infantry training simulations are highlighted. Examples addressing the above are detailed. These include a desktop Infantry representation simulator for use in large scale networked simulations (e.g., CATT). Research directed at improving the terrain fidelity for infantry simulations is also be covered in detail. Finally the strands for future work are outlined briefly including work on the required characteristics of Virtual Environments for effective training applications.
Author
Training Devices; Computerized Simulation; Environment Simulation

20010072757 Defence Evaluation Research Agency, FMC Dept., Bedford, UK
AIRCREW MISSION TRAINING VIA DISTRIBUTED SIMULATION: A NATO STUDY
Tomlinson, B. N., Defence Evaluation Research Agency, UK; The Second NATO Modelling and Simulation Conference; July 2001, pp. 17-1 - 17-10; In English; See also 20010072746; Original contains color illustrations; Copyright Waived; Avail: CASI; A02, Hardcopy

This paper is about the future potential in NATO of Aircrew Mission Training via Distributed Simulation, or MTDS. A Military Applications Study (known as SAS-013) on MTDS has just concluded, having been sponsored by the NATO Research and Technology Organization (RTO), through its Studies, Analysis and Simulation (SAS) Panel. The study report will be published shortly. The task of the study was 'To assess the potential of advanced distributed simulation to complement live flying training in order to enhance NATO capability to conduct combined air operations'. This could be re-phrased as 'How can NATO apply recent improvements in distributed simulation technology to enhance current and future NATO training for air operations?' Note that, according to NATO definitions, 'Combined Operations' are defined as operations between two or more forces or agencies of two or more allies. Joint is defined as activities, operations, organisations, etc., in which elements of more than one service of the same nation participate. This paper will discuss some of the results of the SAS-013 study and will describe plans for further work. The SAS-013 study has been conducted by a multi-national Study Team, led by the UK, consisting of serving Air Force personnel and national experts in simulation technology and

aircrew training from Belgium, France, Germany, Italy, The Netherlands, Turkey, UK, and the USA. Team members also included representatives from the aircraft and the simulation industries.
Author
Training Simulators; Computerized Simulation; Military Technology

20010072758 Royal Military Coll. of Science, Applied Mathematics and Operational Research Group, Shrivenham, UK
COMPUTER GENERATED FORCES BASED ON TACTICAL APPLICATION OF PRINCIPLES OF COMBAT SURVIVABILITY
Price, Sean N., Royal Military Coll. of Science, UK; McBride, Dennis K., University of Central Florida, USA; Sastry, Venkat V. V. S. S., Royal Military Coll. of Science, UK; The Second NATO Modelling and Simulation Conference; July 2001, pp. 18-1 - 18-13; In English; See also 20010072746; Original contains color illustrations; Copyright Waived; Avail: CASI; A03, Hardcopy

Computer generated forces (CGF) technology has succeeded over the past decade due in large part to the collaborative efforts of computer scientists and of military experts. This collaboration was largely driven by various programming, networking, and other computing demands that, in turn, were owned by and thus articulated by software managers. Consequently, military expertise was applied principally in response to software programming requirements. That is, software development - understandably - led CGF development. At the conclusion of the ten-year period since a heralded DARPA-US Army demonstration of large quantities of CGF networked over a wide area network, it is arguable that CGF technology has stabilized, technically and culturally. We propose that such stability supports the beginning of a shift in which military science, as opposed to computer science, drives subsequent evolution of CGF. This shift is necessary because, whilst CGF have certainly been shown to be useful over this period, it is arguable that current CGF implementations do not support the manoeuvrist doctrine that NATO armies espouse. We believe that this shift in CGF ownership may lead to significant increases in the value of CGF technology in line with the requirements of the user community. Pursuant, we contend that the technical domain known widely as combat survivability analysis offers a potentially useful context for research. Ball's classic articulation of survivability analysis outlines six combat dimensions that suffice to define the combat relationships between and among any or all platforms and/or relevant battlefield organizations. The dimensions are evaluated from the perspective of each entity by estimating the probabilities of a threat existing, being detected, identified and tracked by it, it successfully aiming, firing, and detonating some munition and, finally, the probability of destruction by that munition. The calculation of these probabilities allows an entity to estimate a probability of survival for any set of circumstances in which it finds itself. We argue, that an awareness of this threat, when compared to an individually generated aversion to risk, will allow the entity to drive its behaviour in a way that is more in line with the way that real people operate and the way that we would wish a manoeuvrist entity to behave. We outline this approach, together with a program of research that we hope to undertake to validate our ideas.
Author
Software Engineering; Human Behavior; Computerized Simulation; Training Devices

20010072759 Army Simulation Training, and Instrumentation Command, Orlando, FL USA
A SIMULATION FRAMEWORK FOR COMMAND AND STAFF TRAINING
Ball, Charles, Army Simulation Training, and Instrumentation Command, USA; The Second NATO Modelling and Simulation Conference; July 2001, pp. 23-1 - 23-7; In English; See also 20010072746; Copyright Waived; Avail: CASI; A02, Hardcopy

Military operations occur within a wide spectrum of situations including force on force operations (e.g., Grenada), large coalition operations against an enemy force (e.g., Desert Storm), peacekeeping operations as part of an international peacekeeping force (e.g., Bosnia), etc. Each of these situations has a unique set of forces and sides that are involved including, but not limited to the US military, the enemy force, allied coalition forces, non-combatant civilians, nongovernmental organizations, etc. In addition, each requires development of geo-specific databases of the area of operation. The process for constructing, controlling, and reporting on these forces in legacy constructive simulations is typically a labor-intensive, expensive operation. This presentation will describe enhancements in such areas as force laydown, terrain generation, unit control via agent architecture, and after action review (AAR) that provide the potential for more realistic portrayal of military operations at a fraction of the training cost. The approach and results of a proof of principle integration of Warfighter Simulation (WARSIM) software within a simulation framework will be discussed and demonstrated via DVD video segments.
Author
Computerized Simulation; Military Operations; Training Devices

20010072761 Defence Research and Development Canada, Ottawa, Ontario Canada
AN INTEGRATED CANADIAN APPROACH TO CONCEPT DEVELOPMENT, JOINT EXPERIMENTATION AND MODELLING AND SIMULATION
Bovenkamp, John, Defence Research and Development Canada, Canada; The Second NATO Modelling and Simulation Conference; July 2001, pp. 2-1 - 2-18; In English; See also 20010072746; Original contains color illustrations; Copyright Waived

The purpose of this presentation is to give a status report on the development of an integrated Canadian approach to concept development, joint experimentation, and modelling and simulation. In order to establish such an approach, Canada is creating new organizations and infrastructure.
Author
Computerized Simulation; Models; Experimentation

20010072764 British Aerospace Aircraft Group, Warton, UK
SEMB PRESENTATION
Mansell, Mick, British Aerospace Aircraft Group, UK; The Second NATO Modelling and Simulation Conference; July 2001, pp. 6-1 - 6-25; In English; See also 20010072746; Original contains color illustrations; Copyright Waived

The Synthetic Environment Management Board (SEMB) has accepted in principle to adapt the roles and responsibilities required to become the National Advisory Committee (NAC) for Modelling, Simulation, and Synthetic Environment. The NAC will develop and communicate a shared understanding of industry, funding agency, and other stakeholders' needs and priorities for research and technology development, maintain an overview of the UK competitiveness in the relevant technologies, analyze the gaps in research, inform and influence the panels, promote collaboration, and encourage spin-offs.
Derived from text
Priorities; Research And Development; Computerized Simulation

20010072765 North Atlantic Treaty Organization, C3 Agency, The Hague, Netherlands
INTRODUCTION TO THE DIMUNDS 2000 PROJECT AND DEMONSTRATION
Coppieters, Dirk, North Atlantic Treaty Organization, Netherlands; Hamers, Joost, Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek, Netherlands; The Second NATO Modelling and Simulation Conference; July 2001, pp. 7-1 - 7-21; In English; See also 20010072746; Original contains color illustrations; Copyright Waived

This viewgraph presentation demonstrated the feasibility of building a representative simulation capability for CAXs at the NATO Combined Joint Task Force level from proven national simulation models by making use of the High Level Architecture (HLA) for simulation interoperability.
Derived from text
Computerized Simulation; Architecture (Computers); Environment Simulation

20010072766 Matra BAe Dynamics, Stevenage, UK
PROMOTING RE-USE IN SYNTHETIC ENVIRONMENTS BY DEVELOPING GENERIC COMPONENTS
Smith, Rob, Matra BAe Dynamics, UK; The Second NATO Modelling and Simulation Conference; July 2001, pp. 9-1 - 9-33; In English; See also 20010072746; Original contains color illustrations; Copyright Waived

This viewgraph presentation gives an overview of the re-use of synthetic environments (SEs) by developing generic components, including details on the scope (range of simulations and models) and standards, approach and architecture (SE and software compo-

nents), and generic components and toolset, and applications of the technology.
CASI
Architecture (Computers); Computerized Simulation; Computer Programs

20010072767 Defence Evaluation Research Agency, Portsmouth, UK
EXERCISE: 'REACTION COMBINEE'
Watson, Mike, Defence Evaluation Research Agency, UK; Igarza, Jean-Louis, RTA/NMSCO, France; The Second NATO Modelling and Simulation Conference; July 2001, pp. 19(P1)-1 - (19(P1)-24 and 19(P2)-1 - 19(P2)-7; In English; See also 20010072746; Original contains color illustrations; Copyright Waived

The Anglo-French strategic and operational level training exercise using Computer Assistance to enrich the training exercise environment employed a new philosophy for exercise management and provided the use of a parallel simulation system to assess the possible battle outcome to inform EXCON/LOCON of likely future events to sustain 'realism' and the training phase. The CAX requires two phases: (1) Stimulation - operational knowledge transfer; and (2) Simulation - training to make decision command operations.
Derived from text
Stimulation; Training Devices; Computerized Simulation

20010082336 Virtual Prototypes, Inc., Oklahoma City, OK USA
COMMERCIAL OFF-THE-SHELF SOFTWARE AND SIMULATION TOOLS
Veitch, William A., Virtual Prototypes, Inc., USA; Strategies to Mitigate Obsolescence in Defense Systems Using Commercial Components; June 2001, pp. 11-1 - 11-5; In English; See also 20010082326; Original contains color illustrations; Copyright Waived; Avail: CASI; A01, Hardcopy

In this paper the author will present the arguments supporting the case for using Commercial Off-the-Shelf Software and Simulation Tools (COSST) in major defense systems, whether for actual combat, or for embedded training purposes. Whether the objective is a service life extension, new development, or an upgrade to certain system level functions and operations, COSST have come to represent the solution when budgets and time scales are tight and engineering staff are becoming harder to come by. The author will describe how his company's tools have been layered over the engineering, simulation, test and analysis processes at major defense firms to improve reuse, assist in knowledge capture, and to produce results in major weapons systems programs.
Author
Commercial Off-The-Shelf Products; Weapon Systems; Applications Programs (Computers); Technology Utilization

20010082347 BAE Systems, Edinburgh UK
ADOPTING NEW SOFTWARE DEVELOPMENT TECHNIQUES TO REDUCE OBSOLESCENCE
Lane, C. H. R., BAE Systems, UK; Beattie, E. S., BAE Systems, UK; Chita, J. S., BAE Systems, UK; Lincoln, S. P., BAE Systems, UK; Strategies to Mitigate Obsolescence in Defense Systems Using Commercial Components; June 2001, pp. 23-1 - 23-9; In English; See also 20010082326; Original contains color illustrations; Copyright Waived; Avail: CASI; A02, Hardcopy

This paper reports on the advanced techniques employed in the specification of software requirements and the subsequent software development for an E-Scan demonstrator Radar Data Processor. This involves the Rapid Object-oriented Process for Embedded Systems (ROPES), UML syntax, object-oriented design, and automatic code generation and test. The commercial off-the-shelf (COTS) technology reported is in terms of commercially available state of the art method and tool support for the software analysis and design. The resulting software product contains a significant proportion of COTS code resulting from the code-generation. We are also using automation in development of our MMI, a COTS GUI-builder, and COTS hardware and operating system. In this paper we also report on the object-oriented method, using the ROPES process, together with information about how in practice we are implementing the theory. We present the structure of the software and how it relates to the application under development. With these techniques there are significant reductions in obsolescence due to: (1) customer visibility and understanding of the product under procurement, making clear the advantages and limitations of what will be produced; (2) development of a coherent, consistent, and maintainable system specification; (3) use of use an industry-standard model notation (UML) to capture the analysis and design, enabling portability of the design to other tools and products; (4) flexibility in catering for evolving requirements; (5) development of testable requirements, enabling original functionality to be re-checked after addition of enhancements; (6) techniques for enabling the re-use or replacement of modules with defined interfaces; (7) easy and maintainable connections between specification and implementation; and (8) high initial quality and low rework costs. This paper will be of benefit to those just embarking on system and software development, or considering updating processes in a legacy project. It is also applicable to those just embarking on choice of tools and methods for initiating programs as well as for early feasibility studies.
Author
Computer Programs; Object-Oriented Programming; Requirements; Technology Utilization

20010082351 Defence Evaluation Research Agency, Systems and Software Engineering Centre, Malvern, UK
SOFTWARE COTS COMPONENTS: PROBLEMS AND SOLUTIONS?
Dowling, Ted, Defence Evaluation Research Agency, UK; Strategies to Mitigate Obsolescence in Defense Systems Using Commercial Components; June 2001, pp. 28-1 - 28-8; In English; See also 20010082326; Copyright Waived; Avail: CASI; A02, Hardcopy

Commercial off-the-shelf (COTS) components offer a solution to many obsolescence problems, but certain COTS items can also introduce their own difficulties. Commercial operating systems, for example, play a key system role but are single-source and black box, denying the user both the visibility and control of a bespoke item. Open source software in general, but the Linux operating system in particular, seems to offer many of the advantages of COTS but with the added benefit of full access to the source code. However, the widespread adoption of Linux presents not only opportunities but some potential difficulties, for which a possible solution is a dedicated focus within the defense community.
Author
Commercial Off-The-Shelf Products; Operating Systems (Computers)

62
COMPUTER SYSTEMS

20010002538 Army Simulation Training, and Instrumentation Command, Orlando, FL USA
DISMOUNTED WARRIOR NETWORK EXPERIMENTS
Jones, Traci A., Army Simulation Training, and Instrumentation Command, USA; The Capability of Virtual Reality to Meet Military Requirements; November 2000, pp. 16-1 - 16-8; In English; See also 20010002522; Copyright Waived; Avail: CASI; A02, Hardcopy

The Dismounted Warrior Network (DWN) project began in November 1995 with the publication of the STRICOM Individual Combatant Simulation Technology Transfer Plan [11. Sponsored by the US Army Infantry Center (USAIC) and the US Marine Corps (USMC), the purpose of the first phase of DWN was to provide a means of understanding dismounted infantry simulation requirements. A series of experiments and exercises were planned, to include an assessment of the cost and benefits associated with the technologies to immerse the individual combatant within the virtual battlefield. One of the most important products of DWN is a Simulation Task Analysis, which was developed to support simulation for IC in the Training, Exercises, and Military Operations (TEMO), Advanced Concepts and Requirements (ACR), and Research, Development and Acquisition (RDA) domains. A preliminary technology analysis was conducted to assess and select current representative IC simulation technologies for inclusion in the DWN experiments and exercises.
Derived from text
Military Operations; Environment Simulation; Virtual Reality; Training Simulators

20020016341 Military Univ. of Technology, Warsaw, Poland
THE REQUIREMENTS FOR COTS IPV6 NETWORK APPLICATIONS IN TACTICAL NETWORK ENVIRONMENT
Gajewski, Piotr, Military Univ. of Technology, Poland; Bajda, Artur, Military Univ. of Technology, Poland; Krygier, Jaroslaw, Military Univ. of Technology, Poland; Jarmakiewicz, Jacek, Military Univ. of Technology, Poland; Information Management Challenges in Achieving Coalition Interoperability; December 2001, pp. 14-1 - 14-8; In English; See also 20020016329; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

This paper deals with requirements related to the possibilities and limitations of using the commercial-off-the-shelf (COTS) IPv6 (Internet protocol, version 6)) components in tactical communications and information systems. It describes the requirements based on military communications network needs analyses. 'NATO C3 Technical Architecture' by NATO C3 (Command, Control, Communications) Board Information Systems Sub-committee is the main document used for COTS technology evaluation with respect to their application in military environment. Unfortunately, the COTS evaluation method has not been defined yet. They describe only required standard features such as: maturity, availability and stability. The quantitative and qualitative assessment criteria become essential from the following COTS exploitation point of view: quality of service, users' mobility, survivability, security, interoperability and management possibility. This paper describes all mentioned above assessment criteria and the IPv6 usage by COTS elements.
Author
Command And Control; Commercial Off-The-Shelf Products; Communication Networks; Protocol (Computers); Armed Forces; Computer Networks

20020016350 SaabTech Systems A.B., Jaerfaella, Sweden
PROVIDING THE COMMON VIEW OF THE SITUATION: THE WASP APPROACH
Bergman, Niclas, SaabTech Systems A.B., Sweden; Wallenius, Klas, Royal Inst. of Tech., Sweden; Information Management Challenges in Achieving Coalition Interoperability; December 2001, pp. 23-1 - 23-9; In English; See also 20020016329; Original contains color illustrations; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

New commercial network technology brings new cost-effective approaches to information distribution and information sharing. By sharing information, not only does planning and engagement become more efficient, but the information resources themselves also become better utilized. Information sharing allows for wider flexibility in the organizational structure, it decentralizes the decision making, giving faster reactions to new scenarios and unpredicted situations. Moreover, the strive towards a higher interoperability between coalition partners with more frequent and greater joint peace keeping activities also demands a higher level of information sharing. This paper presents the techniques and methodologies for information sharing that has been developed and evaluated within the WASP (Wide Area Situation Picture) project. The WASP system provides a solution based on a distributed and non-hierarchical infrastructure utilizing commercial network technology. The encapsulated software labelled the WASP Correlator Unit (WCU) is designed for easy integration into present systems and for co-operation with standardised NATO (North Atlantic Treaty Organization) links. The paper gives a brief technical overview of the WASP concept and highlights the system performance and functionality by means of results from simulations. The system features include automatic distributed track correlation with optional manual interaction, accurate estimation of data quality, and bandwidth control. The system also provides functionality for selective subscription to information with respect to its geographical origin and data accuracy. Data selection is obtained by use of multicast services in the network, giving each subscriber to the network the part of the global information that is of prime importance from his horizon. Simultaneously, each subscriber feeds the network with all information that will contribute to the global picture concerning both coverage and quality. The system provides global target numbering distributed to all subscribers. The quality of the common situation picture available in the network is naturally affected by the tracking performance at each subscriber feeding the network, but also by the network delay and target maneuverability. The data quality is therefore constantly estimated and monitored by each WCU. The system is fully scalable regarding the number of connected subscribers and due to the generality of the encapsulated WCU, the subscribers can be of fundamentally different types.
Author
North Atlantic Treaty Organization (NATO); Computer Networks; Interoperability; Selective Dissemination Of Information; Information Resources Management

20020016354 Defence Evaluation Research Agency, Malvern, UK
JINI IN MILITARY SYSTEM APPLICATIONS
Wilkinson, Tim, Defence Evaluation Research Agency, UK; Haines, Sue, Defence Evaluation Research Agency, UK; Williams, Craig, Defence Evaluation Research Agency, UK; Information Management Challenges in Achieving Coalition Interoperability; December 2001, pp. 12-1 - 12-18; In English; See also 20020016329; Original contains color illustrations; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

Jini is a distributed computing environment that extends the concept of 'plug-and-play' to networking. A Jini-enabled hardware or software component, or service, can be connected to a Jini network and announce its presence. Existing services on the network can be notified of the arrival of the new service and reconfigure themselves accordingly. Jini provides support for a client that wishes to use such a service, allowing it to locate the service and call on it to perform tasks. This paper is the output of a study to investigate the possible role that the Jini technology could play in the Joint battlespace. In particular, the paper explores Jini's ability to provide a robust, reliable, secure and scalable solution to network service provision, and details the benefits and limitations of Jini with recommendations of how those limitations may be overcome.
Author
Military Technology; Computer Components; Distributed Processing; Computer Networks; Computer Information Security; Java (Programming Language)

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CYBERNETICS, ARTIFICIAL INTELLIGENCE AND ROBOTICS

19990032478 West Virginia Univ., Dept. of Mechanical and Aerospace Engineering, Morgantown, WV USA
ON-LINE LEARNING HARDWARE-BASED NEURAL NETWORKS: APPLICATIONS TO ADAPTIVE CONTROLS AND FAILURE IDENTIFICATION
Napolitano, Marcello R., West Virginia Univ., USA; Innocenti, Mario, Pisa Univ., Italy; Silvestri, Giovanni, Pisa Univ., Italy; System Identification for Integrated Aircraft Development and Flight Testing; March 1999, pp. 33-1 - 33-16; In English; See also 19990032449; Copyright Waived; Avail: CASI; A03, Hardcopy; A04, Microfiche

Neural Networks have shown to be a very attractive alternative to classic adaptation methods for identification and control of non-linear dynamic systems. The purpose of this paper is to show the improvements in neural network applications achievable through the use of a learning algorithm more efficient than the classic Back-Propagation and through the implementation of the neural schemes in parallel hardware. In addition, applications to failure detection and identification of control loop components will be addressed. The paper illustrates dynamic simulations relative to examples of identification and control of non-linear unknown systems with on-line learning for the hardware-based neural architectures performed with both the classic and the Extended Back-Propagation algorithm. The latter algorithm has shown remarkable improvements with respect to the classic algorithm in terms of learning speed, accuracy, and local minimum problems. The neural schemes are implemented in a set of parallel transputer modules with appealing flexibility for on-line applications.
Author
System Identification; Neural Nets; Failure; Self Adaptive Control Systems; Machine Learning; Complex Systems; On-Line Systems; Siso (Control Systems); Control Systems Design

20000037828 Defence Evaluation Research Agency, Land Systems, Robotic Land Vehicles Dept., Chertsey, UK
UK MILITARY REQUIREMENTS FOR UNMANNED LAND VEHICLE COMBAT ENGINEER SUPPORT
Warren, H. A., Defence Evaluation Research Agency, UK; Advances

in Vehicle Systems Concepts and Integration; April 2000, pp. B6-1 - B6-5; In English; See also 20000037804; Copyright Waived; Avail: CASI; A01, Hardcopy

The paper describes the operational requirements and methods of achieving remote operation of Combat Engineer Equipments for use by the UK Army during periods immediately prior to combat, possibly during combat and extensively in post conflict clearance operations. The techniques could also be used in peace support or for non-military applications. Unmanned ground vehicles have several potential applications on the battlefield including reconnaissance, mine clearance and other engineer tasks. The paper examines the teleoperational requirements for the adaptation of existing Combat Engineer Vehicles such as the Chieftain Armoured Vehicle Royal Engineer (CHAVRE), and the Combat Engineer Tractor (CET) and future requirements for service replacement vehicles such as Future Engineer Tank (FET) and Terrier (replacement CET). The benefits of the use of technologies to improve remote control equipment for the combat engineer are discussed with the evolutionary approach of developing vehicles which have greater intelligence, independence, versatility, and which reduce certain manpower tasks at favourable costs savings. The paper discusses specific topics on:- UK Engineer support requirements, direction of UK RLV programme, design philosophy, advantages and disadvantages of using UGVs instead of manned vehicles, safety features and some technology limitations.

Author

Combat; United Kingdom; Military Technology; Pilotless Aircraft; Support Systems; Operations

20000037829 Defence Evaluation Research Agency, Land Systems, Robotic Land Vehicles Dept., Chertsey, UK

UK EXPERIENCE WITH UNMANNED LAND VEHICLES FOR COMBAT ENGINEER APPLICATIONS

Gibson, P. J., Defence Evaluation Research Agency, UK; Advances in Vehicle Systems Concepts and Integration; April 2000, pp. B7-1 - B7-4; In English; See also 20000037804; Copyright Waived; Avail: CASI; A01, Hardcopy

DERA is currently conducting applied research in support of the UK MOD programme for Combat Engineer Equipments which includes Robotic Land Vehicles. Three examples of research into remote operation of combat engineer equipment are described, the Scatterable Mine Clearance Device (SMCD) on a 15 tonne truck, Chieftain Armoured Vehicle Royal Engineers (CHAVRE) with mine plough and fascines, and Combat Engineer Tractor (CET) fitted with 4-in- 1 bucket. The paper addresses the advantages and limitations of operating via remote control and suggests techniques that alleviate some of these problems. All of the systems described used applique kits on in-service vehicles with no vehicle modifications and were intended to be capable of use in operational environments. Adaptation was achievable in less than a day and there was minimum interference with normal operation, change-over to remote control being near instantaneous. The presentation includes a short video clip of aspects such as tele-operation from moving vehicles, vision needs and problems encountered when undertaking specific tasks such as digging and obstacle negotiation. Results of our trials are summarized and pointers given to future research and features that should be incorporated in future systems. Mr. Peter Gibson - Robotics Technical Expert, Defence Evaluation and Research Agency (DERA), Land Systems, Chobham Lane, Chertsey, Surrey, KT16 OEE, UK

Author

United Kingdom; Pilotless Aircraft; Combat; Engineers

20000037830 Institute for Human Factors TNO, Soesterberg, Netherlands

CONTROLLING UNMANNED VEHICLES: THE HUMAN FACTORS SOLUTION

vanErp, Jan B. F., Institute for Human Factors TNO, Netherlands; Advances in Vehicle Systems Concepts and Integration; April 2000, pp. B8-1 - B8-12; In English; See also 20000037804; Copyright Waived; Avail: CASI; A03, Hardcopy

Recent developments and experiences have proven the usefulness and potential of Unmanned Vehicles (UVs). Emerging technologies enable new missions, broadening the applicability of UVs from simple remote spies towards unmanned combat vehicles carrying lethal weapons. However, despite the emerging technology, unmanned does not implicate that there is no operator involved. Humans still excel in certain tasks, e.g. tasks requiring high flexibility or tasks that involve pattern perception, and decision making. An important subsystem in which the technology driven aspects and the human factors driven aspects of UVs meet is in the data-link between the remote vehicle and the operator. The human factors engineer wants to optimize operator performance, which may require a data-link with an extremely large capacity, while other design criteria typically limit the bandwidth (e.g. to lower costs, or because no more bandwidth is available in certain situations). This field of tension is the subject of the present paper. The paper describes two human factors approaches that may help to resolve this field of tension. The first approach is to reduce data-link requirements (without affecting operator performance) by presenting task-critical information only. Omitting information that is not needed by the operator to perform the task frees capacity. The second approach is to optimize performance by developing advanced interface designs which present task-critical information without additional claims on the data-link. An example will be given of both approaches.

Author

Human Factors Engineering; Tension; Operator Performance; Pilotless Aircraft

20000037831 Defence Evaluation Research Agency, Manpower Integration Dept., Farnborough, UK

AN EVALUATION OF INPUT DEVICES AND MENU SYSTEMS FOR REMOTE WORKSTATIONS

White, J., Defence Evaluation Research Agency, UK; McCrerie, C., Defence Evaluation Research Agency, UK; Miles, C., Defence Evaluation Research Agency, UK; Advances in Vehicle Systems Concepts and Integration; April 2000, pp. B9-1 - B9-8; In English; See also 20000037804; Copyright Waived; Avail: CASI; A02, Hardcopy

It is likely that the future air fleet will include uninhabited air vehicles (UAVs) that can be controlled by an operator in a remote location. Such a system will require the operator to experience the same view as the onboard camera to maintain control and keep track of the uninhabited vehicle. It should be borne in mind that uninhabited vehicles are not likely to be continuously operational but deployed only when necessary. The interface must therefore be intuitive, as long periods of time could elapse between missions. The training needs of the operator should therefore be less intensive than those currently necessary for the manned aircraft fleet. As missions may employ a semi-autonomous mode of operation, there is a requirement for transparency between the system and the operator inputs. This paper reports an investigation of the utility of three Windows- driven menu systems and four input devices. Performance with a touchscreen, touchpad, keyboard and mouse was compared on a waypoint re-routing task. It was anticipated that the innovative touchscreen would enhance performance when compared to the more conventional input methods of keyboard or mouse. The literature suggested that performance with the touchpad would not be optimal. The experiment was run in three phases, each phase using a different menu structure. Pull-down menus, pop-up menus and horizontal menus were included. The results show that in this type of scenario, less emphasis should be placed on the menu system to be used than the input device, although pop-up menus may be less desirable. The mouse and the touchscreen provide performance advantages in comparison to the keyboard and the touchpad.

Derived from text

Workstations; Pilotless Aircraft; Control Systems Design; Computer Programs; Devices

20000053181 Krauss-Maffei A.G., Munich, Germany

MOBILITY ANALYSIS OF A HEAVY OFF-ROAD VEHICLE USING A CONTROLLED SUSPENSION

Hoenlinger, M., Krauss-Maffei A.G., Germany; Glauch, U., Krauss-Maffei A.G., Germany; Structural Aspects of Flexible Aircraft Control; May 2000, pp. 23-1 - 23-12; In English; See also 20000053157; Copyright Waived; Avail: CASI; A03, Hardcopy

Driving safety and ride comfort of cross-country vehicles can be improved with the help of a controlled spring/suspension system. The present paper describes the impact of a semiactive and partially active chassis system on the driving behaviour of a cross-country 8x8 wheeled vehicle. The mobility analysis is based on a multibody vehicle model used for simulating cross-country drives and handling. To start with, the fundamental 'Skyhook'-principle is used for control-

ling; vertical accelerations and vehicle movements are clearly reduced on rough tracks and sine wave lanes.
Author
Suspension Systems (Vehicles); Chassis; Tank Trucks; Control Systems Design; Control Simulation

20000061435 Liege Univ., Aerodynamics Group, Belgium
AN OPTIMAL CONTROL THEORY BASED ALGORITHM TO SOLVE 2D AERODYNAMIC SHAPE OPTIMISATION PROBLEMS FOR INVISCID AND VISCOUS FLOWS
Hiernaux, S., Belgian National Foundation for Scientific Research, Belgium; Essers, J.-A., Liege Univ., Belgium; Aerodynamic Design and Optimisation of Flight Vehicles in a Concurrent Multi-Disciplinary Environment; June 2000, pp. 18-1 - 18-12; In English; See also 20000061419; Copyright Waived; Avail: CASI; A03, Hardcopy

With the capacity of today's computers, one can envisage the resolution of shape optimization problems in aerodynamics. Nevertheless, optimization methods require many evaluations of different aero-dynamic configurations, and so are much more expensive than a single analysis. It is therefore mandatory to find methods that evaluate aerodynamic functions and their gradient at the lowest possible computational cost, as well as fast and robust optimization methods. Classical optimization techniques (descent methods) not only require the value of the function to optimize, but also of its gradient. The classical way to compute the gradient is to use a finite-difference formula; the main drawback of this method is due to the fact that n + 1 evaluations of aerodynamic functions are necessary at each iteration, n being the number of parameters defining the geometry to optimize. So, such methods are completely un-suited to aerodynamic shape optimization, because of the high computational cost of the single analysis. Alternative methods (stochastic optimization, genetic algorithms) that don#t require gradient information are also highly costly in term of CPU time. For a few years, techniques for sensitivity analysis based on the optimal control theory have been developed. These techniques derive from the state equations another set of equations called 'adjoint' or 'costate' equations. The solution of these adjoint equations is used to compute the gradient at very low cost; since solving the adjoint equations is equivalent to solve the state equations, the cost of sensitivity analysis is greatly reduced. Some authors use adjoint equations derived from the discretized Euler equations. In this paper, we focus on adjoint equations derived from analytical state equations.
Author
Control Theory; Optimal Control; Two Dimensional Models; Aerodynamic Configurations; Viscous Flow; Shapes; Genetic Algorithms

20010002526 Defence Evaluation Research Agency, LS4 Robotic Land Vehicles, Chertsey, UK
UK MILITARY REQUIREMENTS FOR ROBOTIC LAND VEHICLES
Warren, H. A., Defence Evaluation Research Agency, UK; The Capability of Virtual Reality to Meet Military Requirements; November 2000, pp. 4-1 - 4-4; In English; See also 20010002522; Copyright Waived; Avail: CASI; A01, Hardcopy

This presentation describes the operational requirements and methods of achieving remote operation of Combat Engineer Equipments for use by the UK Army during periods immediately prior to combat, possibly during combat and extensively in battle area clearance operations. The techniques can also be used in peace support. The paper examines the teleoperational requirements for the adaptation of existing Combat Engineer Vehicles such as the Chieftain Armoured Vehicle Royal Engineer (CH AVRE) also known as AVRE tank, and the Combat Engineer Tank (CET) and future requirements for service replacement vehicles such as Future Engineer Tank (FET) and Terrier (replacement CET). The UK sponsor for this work is the Ministry of Defence, Main Building, Whitehall, London. I would like to thank Lieutenant Colonel Philip Poole, SO1 Engineer, DDOR (Engr&NBC) for assistance in offering advice and material on User requirements. DERA Chertsey LS4 department is currently conducting applied research in support of the UK MOD programme for Combat Engineer Equipments and Robotic Land Vehicles.
Author
Armed Forces (Foreign); United Kingdom; User Requirements

20010002529 Defence and Civil Inst. of Environmental Medicine, North York, Ontario Canada
NAVIGATION IN A VIRTUAL ENVIRONMENT USING A WALKING INTERFACE
Grant, Stuart C., Defence and Civil Inst. of Environmental Medicine, Canada; Magee, Lochlan E., Defence and Civil Inst. of Environmental Medicine, Canada; The Capability of Virtual Reality to Meet Military Requirements; November 2000, pp. 7-1 - 7-5; In English; See also 20010002522; Copyright Waived; Avail: CASI; A01, Hardcopy

For years, aircraft crews and armored fighting vehicle crews have benefited from training in the benign, controlled, and instrumented situations created by simulation. Virtual reality (VR) technologies are now starting to bring these benefits to the training of dismounted soldiers. Simulation for dismounted combatants has numerous applications. In current combined arms simulations, only constructive infantry, controlled from a workstation, are available. Their lack of sophistication, relative to their human counterparts, is thought to detract from the validity of the combined arms simulation. Adding virtual infantry would increase the benefit to all participants. Reconnaissance forces and special operations units could plan and rehearse missions using simulation. The ability to explore a future area of operations, such as an airport where hostages are being held, from a first person perspective would allow forces to assess and rehearse lines of fire, escape routes, and fields of view, Similarly, personnel who must enter toxic environments, such as ship's damage control parties and nuclear power station maintenance crews could rehearse different scenarios ahead of time and familiarize themselves with locations they have never visited.
Derived from text
Navigation; Virtual Reality; Computerized Simulation; Human-Computer Interface; Motion Simulation; Environment Simulation

20010002530 Naval Research Lab., Washington, DC USA
PERFORMANCE BASED DESIGN OF A NEW VIRTUAL LOCOMOTION CONTROL
Templeman, James, Naval Research Lab., USA; The Capability of Virtual Reality to Meet Military Requirements; November 2000, pp. 8-1 - 8-9; In English; See also 20010002522; Copyright Waived; Avail: CASI; A02, Hardcopy

The ability to simulate walking around in the environment is a key element missing from most of today's joint forces simulations. A number of sensor-based techniques are widely used to maneuver through Virtual Environments but they introduce artifacts into the interaction. Mechanical motion platforms have also been applied to surmount these difficulties, but they tend to exhibit different but equally troublesome side effects of their own. This paper examines the interrelationships between virtual motion control and other critical actions soldiers need to perform in VE. The goal is to allow the user to maneuver through VE in as similar a manner as possible to walking through the real world. If the interactions between different controls and sensory feedback can be made comparable to the interaction between actions in the real world, then there is hope for constructing an effective new technique. Human performance requirements are viewed from an analytical standpoint: pointing out the interactions between a full set of virtual controls that would allow the user to act, sense, and react to their environment. Candidate solutions are discussed as the analysis is developed. This has lead us to a promising new design for sensor-based virtual locomotion called Gaiter, introduced in this paper.
Author
Motion Simulation; Motion Simulators; Virtual Reality; Environment Simulation

20010002540 Army School of Ammunition, Leamington Spa, UK
REMOTE CONTROLLED VEHICLE 'WHEELBARROW'
Taylor, Barry, Army School of Ammunition, UK; The Capability of Virtual Reality to Meet Military Requirements; November 2000, pp. 18-1 - 18-4; In English; See also 20010002522; Copyright Waived; Avail: CASI; A01, Hardcopy

The Army School of Ammunition in Warwickshire, England is the UK's premier IEDD training establishment, We have been training IEDD operators since about 1922 and most recently our efforts have been centered on the training of individuals for Northern Ireland operations. In addition we also train students from many countries around the world, principally in EOD matters, but also in conventional Land Service Ammunition, which is our main task in the

Field Army. We are currently using and developing two computer-based training systems in the IEDD field. The two systems are: RCV Wheelbarrow MK8B Control Trainer System, and IEDD Threat Assessment Training.
Derived from text
Remote Control; Control Configured Vehicles; Training Simulators

20010002542 Centre des Etudes Terrestraire et Planetaire, Lab. de Robotique de Paris, Velizy, France
TELEPRESENCE AND INTERVENTION ROBOTICS
Cislo, Nathalie, Centre des Etudes Terrestraire et Planetaire, France; The Capability of Virtual Reality to Meet Military Requirements; November 2000, pp. 20-1 - 20-11; In English; See also 20010002522; Copyright Waived; Avail: CASI; A03, Hardcopy

In the field of Mobile Robotics applications dedicated to inspection or intervention in hostile, unreachable or unstructured environments, human operators are 'processed' in the control loop developed for a Telepresence System. On the one hand dynamic situations suffer from a lack of automation degree by mobile robots but on the other hand a complete task robotization can run counter to economic or human constraints. In mine clearance activity for instance, mobile robots and especially teleoperated semi-legged robots can be seen as a solution, not to replace the mine clearance specialists, but as a safe tool for human operators in some well-defined situations. As human interaction with a machine is often oriented towards application, the teleoperation of a mobile robot under geometrical constraints is not easy to achieve if no training period occurred previously for the operator. A footbridge exists between training and relevant missions on navigation tasks: a real activity with a mobile robot can be prepared in a micro-world - a virtual world or an Augmented Reality world. But the use of Telepresence systems, presented here as destined for an inescapable expansion because of cultural yearning with ancestral roots, is submitted to human factors. In this paper, after a discussion about the ubiquity myth in Telepresence, we present a Telelocomotion system with a Control-Command-Communication (C3) strategy adapted in a Service and Intervention context to semi-legged robots like our RAMSES (French acronym for Mobile Autonomous Robot with an Advanced Support System). The vision aspect is focused on and vision sickness issues generated by the motion of visual feedback are analysed. Some solutions to avoid or diminish troubles with either an appropriate camera or specific control laws are presented. Experiments are in progress to study the relevance in Telelocomotion of a Behavioural Transform by means of gestures produced by a dedicated optical fibre glove to operate a legged robot in comparison with the use of a joystick.
Author
Robotics; Robots; Teleoperators; Robot Control; Robot Dynamics; Remote Control; Telerobotics

20010047068 Near East Univ., Dept. of Computer Engineering, Lefkosa, Turkey
AUTOMATIC DETECTION OF MILITARY TARGETS UTILISING NEURAL NETWORKS AND SCALE SPACE ANALYSIS
Khashman, A., Near East Univ., Turkey; New Information Processing Techniques for Military Systems; April 2001, pp. 25-1 - 25-6; In English; See also 20010047042; Copyright Waived; Avail: CASI; A02, Hardcopy

This paper reports on a new approach to detecting military targets. The novel idea is based on combining neural network arbitration and scale space analysis to automatically select one optimum scale for the entire image at which object edge detection can be applied. Thus, introducing new measures to solve many of the problems existing in the discipline of image processing, such as: (1) poor edge detection in medium-contrast images; (2) speed of recognition; and (3) high computational cost. This new approach to edge detection is formalized in the Automatic Edge Detection Scheme (AEDS).
Derived from text
Neural Nets; Target Acquisition; Edge Detection; Image Processing

20010067676 Air Force Research Lab., Wright-Patterson AFB, OH USA
ACTIVE CONTROL TECHNOLOGY FOR ENHANCED PERFORMANCE OPERATIONAL CAPABILITIES OF MILITARY AIRCRAFT, LAND VEHICLES AND SEA VEHICLES TECHNICAL EVALUATION REPORT
Moorhouse, David J., Air Force Research Lab., USA; Active Control Technology for Enhanced Performance Operational Capabilities of Military Aircraft, Land Vehicles and Sea Vehicles; June 2001, pp. T1-1 - T1-5; See also 20010067671; Copyright Waived; Avail: CASI; A01, Hardcopy

Control technology is becoming one of the most pervasive aspects of vehicle design and operation. The engine, subsystems, weapons, etc., all have their individual control systems in addition to the flight control system of the aircraft overall. In addition, we can now control the boundary layer of the flow over the vehicle or inside the engines. As stated in the theme for the symposium: 'The potential exceeds by far that which can be achieved nowadays by careful design using passive components'. This report reviews the symposium relative to the stated objectives.
Author
Active Control; Summaries; Aircraft Control

20010067699 Deutsches Zentrum fuer Luft- und Raumfahrt e.V., Inst. fuer Flugsystemtechnik, Cologne, Germany
USE OF ATTAS FOR ACT RESEARCH
Bauschat, J.-Michael, Deutsches Zentrum fuer Luft- und Raumfahrt e.V., Germany; Duus, Gunnar, Deutsches Zentrum fuer Luft- und Raumfahrt e.V., Germany; Hahn, Klaus-Uwe, Deutsches Zentrum fuer Luft- und Raumfahrt e.V., Germany; Heine, Wieland, Deutsches Zentrum fuer Luft- und Raumfahrt e.V., Germany; Willemsen, Dehlia, Deutsches Zentrum fuer Luft- und Raumfahrt e.V., Germany; Active Control Technology for Enhanced Performance Operational Capabilities of Military Aircraft, Land Vehicles and Sea Vehicles; June 2001, pp. 27-1 - 27-12; In English; See also 20010067671; Original contains color illustrations; Copyright Waived; Avail: CASI; A03, Hardcopy

The application of active control technologies (ACT) has a potential to enhance the operational performance capabilities of aircraft. In particular the introduction of digital computers with today's processing power allows us to think about more and more complex and/or unconventional control schemes for more efficient operation of aircraft. For the final validation and verification of new approaches the flight test is the ultimate test for concept demonstration under real world conditions. For this purpose DLR uses its flying testbed ATTAS (Advanced Technologies Testing Aircraft System) which is ideally suited due to its unique configuration. ATTAS is configured to meet the requirements of a variety of applications by freely programmable functions and interface capabilities to link customer software and hardware. This paper summarizes the recent and current projects and research activities relevant for ACT in which flight testing using AT-FAS is an important factor.
Author
Active Control; Computer Programs; Aircraft Control

20010067712 National Aerospace Lab., Emmeloord, Netherlands
DEVELOPMENT OF ANALYSIS TOOLS FOR ACTIVE SHAPE AND VIBRATION CONTROL
deBoer, A., National Aerospace Lab., Netherlands; Veul, R., National Aerospace Lab., Netherlands; Arendsen, P., National Aerospace Lab., Netherlands; Bakker, M., Universiteit Twente, Netherlands; Active Control Technology for Enhanced Performance Operational Capabilities of Military Aircraft, Land Vehicles and Sea Vehicles; June 2001, pp. 12-1 - 12-7; In English; See also 20010067671
Contract(s)/Grant(s): NIVR-02805N; Copyright Waived; Avail: CASI; A02, Hardcopy

Active shape and vibration control are means for obtaining optimal flow conditions around wings, ducts, and channels under different conditions. This means that the structure can be adapted (deformed or damped) such that aerodynamic or vibro-acoustic behavior is optimal for that particular situation. The fast developments in computer technology makes it possible that more complex analyses in which aerodynamic and vibro-acoustic is included can be applied in the design process. At NLR research is carried out on the integration of advanced analysis tools in design environments. In this paper the tools which are developed for the analysis of active shape and vibration control are presented. The back bone of the design environment is an optimization algorithm which helps the designer to come up with optimal designs of structures. In the case of active shape and vibration control the optimal design of controllers is a new aspect. This means that in addition to the optimization of the

locations of sensors and actuators the control parameters have to be optimized. In this paper a method is proposed to optimize locations and control parameters at once with the standard finite element representation of the equations of motion as a base.
Author
Active Control; Control Systems Design; Position (Location); Actuators; Optimization

20010067742 Ecole Centrale de Paris, Lab. E.M2.C, France
DEVELOPMENTS OF ADAPTIVE METHODS FOR ACTIVE INSTABILITY CONTROL
Mettenleiter, M., Ecole Centrale de Paris, France; Candel, S., Ecole Centrale de Paris, France; Active Control Technology for Enhanced Performance Operational Capabilities of Military Aircraft, Land Vehicles and Sea Vehicles; June 2001, pp. 26-1 - 26-13; In English; See also 20010067671; Copyright Waived; Avail: CASI; A03, Hardcopy

Adaptive algorithms are considered in many applications of active flow control. Independent of the controller type, it is always necessary to provide information on the system to be controlled. A standard method is to identify the system in a first step and then provide the result to the controller. The secondary path information obtained is necessary for the proper convergence of the adaptive filter. This two-step procedure is applicable in many cases but it is not sufficient when the system changes significantly during operation. This study focuses on self adaptive controllers operating with an on-line identification procedure. These systems are devised in this article to control aeroacoustic instabilities of the type found in segmented solid rocket motors. Instabilities are driven by vortex shedding which are coupled by a resonant mode of the system. Two laboratory scale experiments are used as testbeds for the control schemes. Self adaptive control is compared with a standard adaptive method using an off-line identification procedure.
Author
Active Control; Algorithms; Aerodynamic Stability; Adaptive Control

20010067743 California Inst. of Tech., Pasadena, CA USA
ACTIVE FEEDBACK CONTROL OF COMBUSTOR DYNAMICS WITH TIME DELAY AND NOISE
Seywert, C., California Inst. of Tech., USA; Isella, G., California Inst. of Tech., USA; Culick, F. E. C., California Inst. of Tech., USA; Active Control Technology for Enhanced Performance Operational Capabilities of Military Aircraft, Land Vehicles and Sea Vehicles; June 2001, pp. 27-1 - 27-17; In English; See also 20010067671; Copyright Waived; Avail: CASI; A03, Hardcopy

Longitudinal pressure oscillations in a combustion chamber are studied theoretically by means of a low order model obtained by systematic reduction from a complete representation. The formulation is based on the derivation of a generalized wave equation that accommodates the effects of mean flow, combustion, noise, and control action. By using spatial averaging, the equations describing the dynamics of the chamber are reduced to a set of coupled ordinary differential equations. The form of the resulting equations is particularly convenient for model reduction and for introducing feedback control terms, while retaining all physical processes. Active feedback control of longitudinal instabilities is then introduced by using the same formulation, rewritten in state-space form. The broad objective of control simulations covered here is to investigate in a unified fashion various aspects of the problem. These include the influences of noise, parameter uncertainties, unmodeled modes and time-delay. A criterion is derived that guarantees the stability of the controlled closed-loop system in the presence of those quantities. The particular controller used here is based on a standard LQR design, but any design technique can be used as long as the stability criterion is fulfilled.
Author
Active Control; Feedback Control; Pressure Oscillations; Control Theory

20010067754 NASA Langley Research Center, Hampton, VA USA
ACTIVE CONTROL TECHNOLOGY AT NASA LANGLEY RESEARCH CENTER
Antcliff, Richard R., NASA Langley Research Center, USA; McGowan, Anna-Marie R., NASA Langley Research Center, USA; Active Control Technology for Enhanced Performance Operational Capabilities of Military Aircraft, Land Vehicles and Sea Vehicles; June 2001, pp. 7-1 - 7-13; In English; See also 20010067671; Original contains color illustrations; Copyright Waived; Avail: CASI; A03, Hardcopy

NASA Langley has a long history of attacking important technical opportunities from a broad base of supporting disciplines. The research and development at Langley in this subject area range from the test tube to the test flight. The information covered here will range from the development of innovative new materials, sensors and actuators, to the incorporation of smart sensors and actuators in practical devices, to the optimization of the location of these devices, to, finally, a wide variety of applications of these devices utilizing Langley's facilities and expertise. Advanced materials are being developed for sensors and actuators, as well as polymers for integrating smart devices into composite structures. Contributions reside in three key areas: (1) computational materials; (2) advanced piezoelectric materials; and (3) integrated composite structures.
Derived from text
Active Control; Actuators; Composite Structures; Piezoelectricity

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NUMERICAL ANALYSIS

20000011762 Army Aeromedical Research Lab., Fort Rucker, AL USA
HUMAN FACTORS AND PERFORMANCE CONCERNS FOR THE DESIGN OF HELMET-MOUNTED DISPLAYS
Rash, C. E., Army Aeromedical Research Lab., USA; McLean, W. E., Army Aeromedical Research Lab., USA; Mozo, B. T., Army Aeromedical Research Lab., USA; Licina, J. R., Army Aeromedical Research Lab., USA; McEntire, B. J., Army Aeromedical Research Lab., USA; Current Aeromedical Issues in Rotary Wing Operations; August 1999, pp. 30-1 - 30-19; In English; See also 20000011735; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

Since the 1970s, the trend in Army aviation has been to rely increasingly on helmet-mounted display (HMD) devices or systems to provide the aircrew with pilotage imagery, flight information, and fire control imagery and symbology. Design specifications for future HMDs must be guided by system parameter criteria convolved with hardware limitations, human performance strengths and weaknesses, and good human factors engineering practices. In this paper, past and ongoing research of HMDs is combined to identify potential sources of performance degradation and health hazards. While recognizing the importance of acoustical and biodynamic issues, the major focus here is on optical and visual issues, which include binocular rivalry, fusion, visual illusions, spatial disorientation, and image quality. Related human factors issues also are discussed.
Author
Human Factors Engineering; Helmet Mounted Displays; Design Analysis; Flight Crews; Display Devices; Image Resolution; Visual Tasks

66
SYSTEMS ANALYSIS AND OPERATIONS RESEARCH

19990028611 Research and Technology Organization, Neuilly-sur-Seine, France
LAND OPERATIONS IN THE YEAR 2020 (LO2020) *[OPERATIONS TERRESTRES A L'HORIZON 2020 (LO2020)]*
March 1999; 268p; In English
Report No.(s): RTO-TR-8; AC/323(SAS)TP/5; ISBN 92-837-1015-0; Copyright Waived; Avail: CASI; A12, Hardcopy; A03, Microfiche; US Distribution and Sales Only

This is the final report of the Long-Term Scientific Study on Land Forces in the Year 2020. This study identified the types of land forces and their capabilities and characteristics that will be required on the NATO battlefield in the year 2020 for warfighting and other military operations. This information provides SHAPE, and subsequently the

major NATO Commanders, with a basis for long-term requirements and defence planning guidance.
Author
North Atlantic Treaty Organization (NATO); Military Operations; Warfare; Military Technology

19990040736 Defence Evaluation Research Agency, Sensors and Processing Sector, Farnborough, UK
AIR-TO-GROUND WEAPON AIMING: A BRIEF SYNOPSIS TO DATE AND A LOOK TO THE FUTURE
Edwards, K. L., Defence Evaluation Research Agency, UK; Loyd, S. J., Royal Air Force, UK; Ralph, J. F., Defence Evaluation Research Agency, UK; Aircraft Weapon System Compatibility and Integration; April 1999, pp. 26-1 - 26-12; In English; See also 19990040714; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

A review of air-to-ground weapon aiming is given, with emphasis placed on the use of the Head-Up Display (HUD), the main cockpit instrument used for accurate weapon aiming over the last 35 years. Nevertheless, the HUD is only of use for the aiming of forward-firing weapons. More weapons have an off-axis capability and their aiming is greatly facilitated by the use of a Helmet-Mounted Sight (HMS) or Helmet-Mounted Display (HMD). The surface-to-air threat and the rules of engagement particularly in operations other than war, place high demands on the aircrew and the weapon aiming system, both to stand off from the target and to have a high degree of confidence that it is the target. The requirement to perform an accurate in-flight transfer alignment of the weapon places further demands upon the aircrew. Timely and accurate target data, digitally received, plus an on-board targeting system which can automatically search for and recognise a target, are of great utility in the final stages prior to weapon release. The Defence Evaluation and Research Agency is performing research in these areas.
Author
Weapons Delivery; Air To Surface Missiles; Head-Up Displays; Helmet Mounted Displays; Pilot Support Systems

19990092808 Orincon Corp., San Diego, CA USA
MEASURES OF MERIT FOR COLLABORATIVE COLLECTION, CONNECTION AND EXECUTION MANAGEMENT
Kowalski, Charlene, Orincon Corp., USA; Stubberud, Stephen, Orincon Corp., USA; Klamer, Dale, Orincon Corp., USA; Alford, Mark, Air Force Research Lab., USA; Sensor Data Fusion and Integration of the Human Element; February 1999, pp. 5-1 - 5-8; In English; See also 19990092805
Contract(s)/Grant(s): F30602-97-C-0010; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

One of the most important aspects of any combat engagement is the effective gathering of intelligence information. To accomplish this information gathering in modern battlefields, many sensor platforms are deployed. These platforms are typically stovepiped systems that operate independently of each other and require considerable operator intervention to interpret collected information and adjust the collection plan accordingly. With automated methods, these sensor platforms could collaborate with each other and share information. As a result, the gathered information could be fused together to increase understanding of the overall picture of the battlefield. We are developing a system that facilitates this interaction among platforms. This system of Measures of merit (MOMs) implements metrics across platforms at various levels of the fusion and data gathering process. When additional.information is needed, the metrics are aggregated to measure the value added that an additional platform can make to the mission and to the overall battlefield perspective. Intelligent agents distributed among the platforms prioritize the requesting and gathering of information from other platforms as well as from the host sensor suit. We are applying MOMs to the collection, connection and execution chain of events for intelligence surveillance and reconnaissance (ISR). In this paper, we describe MOMs systems and its primary components.
Author
Automatic Control; Deployment; Management Systems; Reconnaissance; Surveillance; Military Technology

19990092821 Defence Research Establishment Valcartier, Decision Support Tech. Section, Val Belair, Quebec Canada
ENVIRONMENT PERCEPTION PROCESS IN MARITIME COMMAND AND CONTROL
Paradis, Stephane, Defence Research Establishment Valcartier, Canada; Treurniet, Willem, Physics and Electronics Lab. TNO, Netherlands; Roy, Jean, Defence Research Establishment Valcartier, Canada; Sensor Data Fusion and Integration of the Human Element; February 1999, pp. 19-1 - 19-8; In English; See also 19990092805; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

Various operational trends in naval warfare such as technical logical advances in threat technology and an ongoing shift in littoral warfare, put the shipboard decision making process under pressure. Data must be processed under time-critical conditions and as a consequence the risk of saturation in building the tactical picture and of making the wrong decision increases. One must also realize that the human plays an essential role in the naval command and control cycle. Situation awareness is essential for commanders and their staff to conduct decision-making activit4ies. Data fusion is seen as an essential process to enable operators to achieve situation awareness. This paper discusses the environment perception process (EPP) as an important aspect of the problem of dynamic decision making in the context of naval command and control. The EPP is aimed at achieving the first level of situation awareness that forms the basis for the subsequent more abstract levels. The quality of the results of the EPP is that of utmost importance for the situational awareness that can be achieved at the higher levels. This paper is a step towards the definition of an integrated architecture for data fusion giving emphasis to situation awareness in the context of dynamic human decision making. Such an integrated architecture facilitates the proper conceptualization and design of decision support systems taking into account the human role in the command and control cycle.
Author
Command And Control; Decision Support Systems; Multisensor Fusion; Imaging Techniques; Data Integration

20000011741 Civil Guard, Helicopter Unit, Valencia, Spain
CURRENT OPERATIONAL ISSUES IN THE CIVIL GUARD AIR SERVICE
Llamas, Bernardo Baldanta, Civil Guard, Spain; Current Aeromedical Issues in Rotary Wing Operations; August 1999, pp. 6-1 - 6-6; In English; See also 20000011735; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

The aim of this paper is to present a short description of the Helicopter Units of the Civil Guard. Beginning with a description of the general tasks of the Civil Guard, its organization and statute of its personal. Later on, a superficial approach to the Helicopter Units within the Civil Guard is exposed. In this paragraph, I will discuss some aspects such as the organization, the territorial deployment, the aircraft models that it fly, the missions that it fulfilled, and finally a study of the operational problems that often appear in the such missions development.
Author
Civil Aviation; Aircraft Models; Deployment; Operational Problems; Human Factors Engineering

20000011742 Ministry of Emergencies and Affairs of Population from the Consequences of Chernobyl Catastrophe, Main Center for Coordination of Air Search and Rescue Operations, Kiev, Ukraine
OPERATION OF HELICOPTERS DURING THE CHERNOBYL ACCIDENT
Masharovsky, M., Ministry of Emergencies and Affairs of Population from the Consequences of Chernobyl Catastrophe, Ukraine; Current Aeromedical Issues in Rotary Wing Operations; August 1999, pp. 7-1 - 7-4; In English; See also 20000011735; Copyright Waived; Avail: CASI; A01, Hardcopy; A03, Microfiche

In this report I would like to discuss our experiences with the use of 'small' aviation (helicopters) during the tragic events of April 1986, and during the aftermath of the accident at the Chernobyl Nuclear Power Station. In addition, I will report on the creation of the State System for the Response to Aircraft Incidents and on the use of aircraft during emergencies. The Chernobyl catastrophe was an extraordinary event of a planetary scale. It affected the lives and activities of many millions of people, not only in Ukraine, but also in Russia and Belarus. It has resulted in substantial financial losses and has obstructed the implementation of many agricultural programs. Although the tragic event happened twelve years ago, the problems caused by it are still with us. We are reminded of it on a daily basis by the suffering of many people and by a multitude of

social problems, which add to the burden of today's conditions of our country.
Author
Aircraft Accidents; Helicopter Performance; Ukraine; Aerospace Medicine; Emergencies

20000011744 Etat-Major de la Marine, Div. Programmes, Toulon, France
COMBAT SEARCH AND RESCUE IN NAVAL AVIATION: ADRIATIC EXPERIENCE *[RECUPERATION ET SAUVETAGE DE COMBAT: EXPERIENCE DE L'AERONAUTIQUE NAVALE EN ADRIATIQUE]*
Sicard, Bruno A., Etat-Major de la Marine, France; Current Aeromedical Issues in Rotary Wing Operations; August 1999, pp. 10-1 - 10-3; In French; See also 20000011735; Copyright Waived; Avail: CASI; A01, Hardcopy; A03, Microfiche

Since 1994, two naval reconnaissance aircrafts from French carriers deployed in the Adriatic have been damaged by enemy fire over former-Yugoslavia. Retrieving military personnel from enemy lines became a topical issue. Rescuing people in a hostile zone requires a wide spectrum of equipment and skills, in a highly coordinated operation that few countries can afford. Such a Combat Search And Rescue (CSAR) mission can be conducted autonomously and at short notice by US or French carriers, since they carry all the required assets: 1) command and control with the Commander Task Force and his head quarters, including intelligence and weather forecasting. 2) a Super-Frelon helicopter squadron. This tactical transport helo provides a large cabin with lateral and back doors which allow flexibility in operational use. The crews are trained to fly with Night Vision Goggles (NVG). 3) an attack squadron with Super-Etendard fighters which provide a combat air patrol capability. 4) an airborne radar (currently Breguet Alize and by the end of 1998 the Grumman E-2C). 5) commandos with a Marine Commando detachment on board. 6) medical support with the carrier medical and surgical team, familiar with Search And Rescue missions. All these personnel, from Admiral to aircrew, commandos, intelligence and medical officers are used to living and practicing together in the confines of a carrier. We discuss skills, coordination and trust developped during Adriatic deployments for this multidisciplinary mission. As a result we field an optimized CSAR medical system which uses a coded medical report, and specific procedures adapted to NVG environment and tactical helo operations. Therefore, from our experience. a carrier group, operating close to a hostile shore, is a sophisticated finely tuned tool, adapted to conduct a short notice CSAR operation.
Author
Combat; Rescue Operations; Searching; Navy; Adriatic Sea; Flight Crews; Aerospace Medicine

20000032382 Turkish Naval Academy, Istanbul, Turkey
FLIGHT OPTIMIZATION IN RECONNAISSANCE MISSIONS
Oner, Adalet, Turkish Naval Academy, Turkey; Kayaligil, Sinan, Middle East Technical Univ., Turkey; Modelling and Analysis of Command and Control; June 1999, pp. 22-1 - 22-15; In English; See also 20000032361; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

There are multiple surface units (targets) detected earlier by radars in a particular sea area. An observer (an air vehicle) will try to identify those moving targets by passing them within the specified identification range of its sensors to maximize the flow rate of information coming from identification. A Branch and Bound algorithm is proposed to optimize the flight pattern of the observer.
Author
Command And Control; Reconnaissance; Detection; Target Recognition; Surveillance; Flight Optimization

20000037824 National Aerospace Lab., Amsterdam, Netherlands
A FRAMEWORK FOR THE AUTOMATION OF AIR DEFENCE SYSTEMS
Choenni, Sunil, National Aerospace Lab., Netherlands; Leijnse, Kees, National Aerospace Lab., Netherlands; Advances in Vehicle Systems Concepts and Integration; April 2000, pp. B1-1 - B1-8; In English; See also 20000037804; Copyright Waived; Avail: CASI; A02, Hardcopy

The need for more efficiency in military organizations is growing. It is expected that a significant increase in efficiency can be obtained by an integration of communication and information technology. This integration may result in (sub)systems that are fully automated, i.e., systems that are unmanned, including unmanned vehicles. In this paper, we focus on the automation of air defence systems! in which integration of communication and information technology is a major issue. We propose an architecture, in which each weapon system has the capability to control itself, whilst acting in a co-ordinated manner with other systems. To realise this task, a weapon system is exactly informed about the activities of all other weapon systems. In our architecture, the role of the men is reduced to the supervision of weapon systems.
Author
Air Defense; Automatic Control; Telecommunication; Information Systems

20000037827 Tusas Aerospace Industries, Design and Development Dept., Ankara, Turkey
AN ANALYSIS ON OPERABILITY OF TACTICAL UNMANNED AERIAL VEHICLE SYSTEMS OVER TURKISH TERRITORY
Ertem, Ozcan, Tusas Aerospace Industries, Turkey; Mandas, Gokhan, Tusas Aerospace Industries, Turkey; Advances in Vehicle Systems Concepts and Integration; April 2000, pp. B5-1 - B5-7; In English; See also 20000037804; No Copyright; Avail: CASI; A02, Hardcopy

The requirements for operational arena of Tactical Unmanned Aerial Vehicles (TUAV) are highly effected with the geographical and weather conditions. A TUAV requirement for a flat terrain with moderate weather over the year varies dramatically from a mountainous terrain with severe weather conditions. Availability of the infrastructure such as airfields, highways is another contributing factor towards the system requirements. Transportability brings another concern when TUAV system is to be deployed by existing aerial assets. This paper evaluates the conditions of Turkish territory and infrastructure; transportability/mobility and therefore tries to approach to the best set of requirements for a TUAV system, with a review of crew and ground vehicles that can operate in Turkish Armed Forces.
Author
Pilotless Aircraft; Turkey; Operational Problems; Geography; Armed Forces

20000037842 General Atomics Aeronautical Systems, Inc., San Diego, CA USA
US PREDATOR OPERATIONS: UPDATE
Porter, John C., General Atomics Aeronautical Systems, Inc., USA; Advances in Vehicle Systems Concepts and Integration; April 2000, pp. B24-1 - B24-5; In English; See also 20000037804; Copyright Waived; Avail: CASI; A01, Hardcopy

The U.S. Predator unmanned aerial vehicle system produced by General Atomics Aeronautical Systems. Inc. has completed three extended operational deployments and has recently commenced a fourth deployment in support of United Nations and American operations in Bosnia-Herzegovina. The Predator system has also recently commenced a deployment to a site in Kuwait. Predator provides operational commanders and their intelligence staffs with valuable and timely live imagery and imagery derived intelligence, often not available from any other source. Through the conduct of these deployments, the operational concept to make best use of the real time reconnaissance capability of Predator has continued to evolve. This paper will provide an overview of the system and a description of the operations with a focus on the changes that have occurred since the original deployment in July 1995.
Derived from text
Deployment; Pilotless Aircraft; United States; Operations Research

20000037843 Bundesamt fuer Wehrtechnik und Beschaffung, Koblenz, Germany
SHORT RANGE RECONNAISSANCE: THE LUNA EXPERIMENTAL UAV PROGRAM
Sabarz, Werner, Bundesamt fuer Wehrtechnik und Beschaffung, Germany; Wernicke, Joachim, EMT Ingenieurgesellschaft Dip. Ing. Hartmut Euer m.b.H., Germany; Advances in Vehicle Systems Concepts and Integration; April 2000, pp. B25-1 - B25-5; In English; See also 20000037804; Copyright Waived; Avail: CASI; A01, Hardcopy

This paper reports on the background, the performance re-

quirements, technical characteristics, special program features and lessons learned from the LUNA Experimental UAV Program. This program is being funded by the R&D Program of the Bundeswehr. This 18 month effort will be finalized by phase 2 field trials in may/june 1999. Main goals to be proven are, reconnaissance performance in an operational environment and easy handling i.e. mission planning, mission conduct and maintenance. The lessons learned from LUNA so far can be applied to other programs - already today, but also particularly in the future.
Derived from text
Pilotless Aircraft; Aerial Reconnaissance; Aircraft Performance

20010003245 Research and Technology Organization, Human Factors and Medicine Panel, Neuilly-sur-Seine, France
USABILITY OF INFORMATION IN BATTLE MANAGEMENT OPERATIONS *[L'EXPLOITATION DE L'INFORMATION DANS LES OPERATIONS DE GESTION DU CHAMP DE BATAILLE]*
Usability of Information in Battle Management Operations; November 2000; 234p; In English; 10-13 Apr. 2000, Oslo, Norway; See also 20010003246 through 20010003267; CD-ROM contains full text document in PDF format; Original contains color illustrations
Report No.(s): RTO-MP-57; AC/323(HFM)TP/29; ISBN 92-837-0017-1; Copyright Waived; Avail: CASI; A11, Hardcopy; A03, Microfiche; C01, CD-ROM

On 10-13 April 2000, NATO, Partnership for Peace, and Non-NATO nationals from 21 countries met in Oslo, Norway to discuss the perceptual, cognitive, social, and contextual factors and considerations that will impact the usefulness and usability of information and information technologies in battle management operations. Sponsored by the Human Factors and Medicine Panel of the North Atlantic Treaty Organization's Research and Technology Organization, the symposium participants discussed the problem, research approaches and techniques for improving team performance and enhancing effectiveness, concepts for battlespace visualization and decision support, and the integration of collaborative battle management systems. The symposium included four Keynote Addresses and sessions on: (1) Operational Problems in Battlespace Management; (2) Team Performance; (3) Techniques for Enhancing Battlespace; (4) Visualization and Decision Support; (5) Decision Support Considerations; and (6) Integration and Test of Battle Management Systems.
Author
Conferences; Management Systems; Operational Problems; Teams; Social Factors; Information Systems; Command And Control; Military Technology

20010003249 Institute for Human Factors TNO, Soesterberg, Netherlands
A RESEARCH FRAMEWORK FOR COMMAND CENTER TEAMS
Rasker, Peter Christian, Institute for Human Factors TNO, Netherlands; Post, Wilfried Maria, Institute for Human Factors TNO, Netherlands; Usability of Information in Battle Management Operations; November 2000, pp. 4-1 - 4-9; In English; See also 20010003245; Copyright Waived; Avail: CASI; A02, Hardcopy

The effectiveness of a command center largely depends on the effectiveness of the team that keeps it going. This paper describes a framework of five research methods to investigate command center teams. These methods comprise modelling, observing, experimentation, design, and evaluation. Modelling implies breaking up a whole human-human-machine system into essential elements. It is an analysis resulting in a clear description of the system. Observation is needed to identify possible bottlenecks in the command center. It yields insight in the composite set of factors that influence the effectiveness of the command center team. Single factors can be investigated systematically by experimentation using a contrived experimental task. The knowledge that is gained by modelling, observation, and experimentation can lead to the design of a new command center team, or the redesign of current ones. Finally, any particular design may need an evaluation to determine how team performance is effected. The application of the framework is illustrated by a number of research projects.
Author
Teams; Command And Control; Observation; Command Guidance; Evaluation

20010003252 National Defence Coll., Dept. of Operational Studies, Stockholm, Sweden
WHEN THEORY BECOMES PRACTICE: INTEGRATING SCIENTIFIC DISCIPLINES FOR TACTICAL MISSION ANALYSIS AND SYSTEMS DEVELOPMENT
Worm, Arne, National Defence Coll., Sweden; Usability of Information in Battle Management Operations; November 2000, pp. 9-1 - 9-9; In English; See also 20010003245; Copyright Waived; Avail: CASI; A02, Hardcopy

The dynamics of tactical missions are of a specific nature. Determined and shrewd exploitation and control of their inherent real-time, safety-critical operational dynamics are vital for success in a wartime or disaster scenario. This paper describes research and development of theories, methods and tools for modeling, analysis, and accident prevention in precarious time-critical air traffic control, process control, emergency response, and military operations. We performed case studies, field studies, and experiments using a combined systems theory, Cognitive Systems Engineering and psychophysiology framework. We carried out Joint Tactical Cognitive Systems identification, modeling, and synthesis, and investigated inherent command, control, and intelligence activities. We found significant relations between workload, time pressure, cognitive complexity, and physiological stress responses.
Author
Accident Prevention; Command And Control; Emergencies; Military Operations; Physiological Responses; Research And Development

20010003254 Science Applications International Corp., Joint Readiness and Analysis Div., Norfolk, VA USA
\MEETING THE CHALLENGE OF PROVIDING VISIBILITY OF FORCE READINESS AND CAPABILITIES IN A MULTINATIONAL ENVIRONMENT
Cryan, William M., Science Applications International Corp., USA; Usability of Information in Battle Management Operations; November 2000, pp. 11-1 - 11-9; In English; See also 20010003245; Copyright Waived; Avail: CASI; A02, Hardcopy

This is a challenging time for the Alliance. What are the true warfighting capabilities of the Alliance? In assessing those capabilities, what metrics is required to assess a unit's joint readiness? With increasing demands being placed on NATO military forces, there is a growing need for Senior Decision-makers to receive more timely, analytical, and flexible readiness assessments. Therefore, the Alliance must be able to assess and prioritize missions, essential tasks, and operational requirements. This paper examines the challenges of developing and maintaining visibility of force readiness and capabilities within a multinational environment. Alliance and Member Nation/Service policies on force readiness and capability vary widely and often provide only a limited snapshot of a unit's ability to conduct its primary wartime mission and not the actual military operations they are undertaking. The challenge for the Alliance is to maintain readiness to support near-term force requirements as well as the long-term requirements of preparing for future security challenges. While technological advances occur rapidly, changes to readiness policies and reporting procedures move more slowly. This reality is more complex within a multinational environment due to the requirement to extract data from existing heterogeneous, legacy Alliance databases in order to present a coherent view of Alliance forces and their respective headquarters activities. This paper outlines a technology strategy for visualization of readiness information and for developing a force readiness decision support system for use in a multinational environment to support the monitoring and assessment of Alliance forces with respect to: (1) Unit reports (location, status, availability, etc.); (2) Determining tactical and operational readiness (personnel, equipment, training and supplies, operations and interopcrability); (3) Availability of military/civilian airlift, sealift and land transportation assets; (4) Availability of pre-positioned equipment; (5) Mobilization capability; (6) Analyzing operations or contingencies from a force readiness perspective; and (7) 'What if' analyses of force capabilities.
Author
Decision Support Systems; Military Operations; Warfare; Evaluation

20010003265 Universitaet der Bundeswehr Muenchen, Neubiberg, Germany
DETECTING USABILITY PROBLEMS WITH EYE TRACKING IN AIRBORNE BATTLE MANAGEMENT SUPPORT
Flemisch, Frank Ole, Universitaet der Bundeswehr Muenchen,

Germany; Onken, Reiner, Universitaet der Bundeswehr Muenchen, Germany; Usability of Information in Battle Management Operations; November 2000, pp. 23-1 - 23-13; In English; See also 20010003245; Copyright Waived; Avail: CASI; A03, Hardcopy

Information is a key element for success or failure on future battlefields. Continuous advances in information technology and battle management systems, especially growing computer capacity and interoperability promise to provide comprehensive tactical situation awareness down to unit level, thereby improving mobility, survivability and sustainability of today's weapon systems. However increased availability of information in the computerized support systems does not automatically lead to increased usability. It rather may lead to information proliferation, hidden information and pertinent problems regarding operator information processing. These problems even grow under time pressure in a stressful environment. Are these problems unavoidable? Or is there a solution to handle the overwhelming amount of information which tomorrows battle management systems and personal have to work on? In aviation there were tremendous technological efforts during the last twenty years to answer similar questions through increase of automation like the introduction of flight management systems or fully computerized 'glass cockpits'. Again, to the surprise of many people, the relative safety did not increase, but remained almost constant.
Author

Flight Management Systems; Information Management; Information Systems; Management Systems; Military Technology; Flight Optimization

20010003266 Mitre Corp. European Operations, Stuttgart, Germany

APPLYING 'COLLABORATION' TO USA EUROPEAN COMMAND (USEUCOM) MISSION PROCESSES

Dodd, Steve, USEUCOM Intelligence Directorate; Chapin, Gregory G., Mitre Corp. European Operations, Germany; Usability of Information in Battle Management Operations; November 2000, pp. 25-1 - 25-15; In English; See also 20010003245; Copyright Waived; Avail: CASI; A03, Hardcopy

'The ability to reach back and use capabilities in the continental USA to perform functions formerly accomplished only in the theater of military operations is one of the highlights of operation Allied Force. Such capability improves responsiveness to urgent requirements in a conflict and reduces the amount of equipment and the number of personnel that must be transported to the theater. In short, the capability to integrate our force globally yields significant improvements in our ability to respond to crises, particularly during their initial stages...' (Kosovo/Operation Allied Force After-Action Report to Congress). This paper describes how collaboration can be applied to mission processes and support deliberate and crisis planning and operations. Operation Allied Force operators stated that proper application of collaboration improved the effectiveness of information processes, improved product quality, and benefited federated efforts by geographically separated partners. During Operation Allied Force, USEUCOM operators demonstrated that collaboration can benefit mission effectiveness. Applying collaboration to existing or modified mission processes needs to be continued, refined, and expanded to include NATO allies. This paper serves as a reminder of the most important system component, the military operators, who effectively applied collaboration to benefit mission processes. The assistance of Lt Col Western, LTC Stearns, LCDR Kraft, and SMSgt Schwarting is appreciated. The dedicated efforts of LCDR Dodd as operational advisor and key contributor are also recognized.
Author

Military Operations; Communication; Warfare; Management Systems

20010003267 Institute for Human Factors TNO, Soesterberg, Netherlands

SMARTSTAFF: A SUPPORT CONCEPT FOR STAFF PLANNING

Post, Wilfried Maria, Institute for Human Factors TNO, Netherlands; Hamaker, Pieter, Institute for Human Factors TNO, Netherlands; Usability of Information in Battle Management Operations; November 2000, pp. 5-1 - 5-7; In English; See also 20010003245; Copyright Waived; Avail: CASI; A02, Hardcopy

A new concept has been evaluated to support decision making in teams. The concept encompasses a shared representation and interactive use of planning information in a team environment, and consists of individual workplaces, generation and representation of ideas, and shared interactive large screen displays. This so-called SmartStaff concept has been evaluated during a simulated operation by the Task Group Staff of the Royal Netherlands Navy. By means of questionnaires the staff members were asked to assess their current work environment and the potentials of SmartStaff. The results show that the concept provides better general support for group decision making. SmartStaff supported better the presentation and conveyance of ideas, facilitated time management and decreased the ambiguities of the plans presented. However, the quality of the final plan did not improve.
Author

Decision Making; Information Systems; Information Management; Planning; Teams; Evaluation

20010033270 Cranfield Univ., Applied Mathematics and Operational Research Group, Shrivenham, UK

A VIRTUAL ENVIRONMENT FOR NAVAL FLIGHT DECK OPERATIONS TRAINING

Sastry, Venkat V. S. S., Cranfield Univ., UK; Steel, Joseph, Cranfield Univ., UK; Trott, Edward A., Defence Procurement Agency, UK; What is Essential for Virtual Reality Systems to Meet Military Human Performance Goals?; March 2001, pp. 1-1 - 1-6; In English; See also 20010033269; Copyright Waived; Avail: CASI; A02, Hardcopy; A02, Microfiche

The main aim of this paper is to develop a prototype virtual environment for training Flight Deck Officers with a view to study the types of interactions required in such an environment. The application is ideally suited to exploit techniques based on proprioception, in particular the trainee's arm signals.
Author

Prototypes; Virtual Reality; Computerized Simulation; Environment Simulation

20010035146 Research and Technology Organization, Systems Concepts and Integration, Neuilly-sur-Seine, France

SYSTEMS CONCEPTS FOR INTEGRATED AIR DEFENSE OF MULTINATIONAL MOBILE CRISIS REACTION FORCES *[CONCEPTS DE SYSTEMES POUR LA DEFENSE AERIENNE INTEGREE DE FORCES INTERNATIONALES MOBILES D'INTERVENTION EN SITUATION DE CRISE]*

Systems Concepts for Integrated Air Defense of Multinational Mobile Crisis Reaction Forces; March 2001; 246p; In English; Systems Concepts and Integration Panel (SCI) Symposium; 22-24 May 2000, Valencia, Spain; See also 20010035147 through 20010035164; CD-ROM contains full text document in PDF format; Original contains color illustrations

Report No.(s): RTO-MP-063; AC/323(SCI-085)TP/29; ISBN 92-837-1052-5; Copyright Waived; Avail: CASI; A11, Hardcopy; A03, Microfiche; C01, CD-ROM

The meeting proceedings from this symposium on 'System Concepts for Integrated Air Defense of Multinational Mobile Crisis Reaction Forces' was organized and sponsored by the Systems Concepts and Integration (Set) Panel of the Research and Technology Organization of NATO in Valencia, Spain on 22 to 24 May 2000. The symposium's goal was to describe techniques and technologies viable for the lay-out and design of operational air defense systems that meet multinational requirements. The papers were presented under the following headings: Description of typical scenarios; Enabling Technologies for Air Defense Systems (Sensors (IR, RADAR, UV, LASER), Sensor Fusion, Pointing and Tracking, Soft Computing, Information Processing, High Level knowledge-based (KB) Automation, Data-Link, and communication); System Architecture and Mechanization; Man-Machine Interface, Visualization techniques; Interface with Weapon Systems and higher level Battlefield Management; and Systems Design for Interoperability.
Author

Conferences; International Cooperation; Air Defense; Command And Control; Communication; Military Operations

20010035147 Bodenseewerk Geraetetechnik G.m.b.H., Ueberlingen, Germany

SILENT-MODE AIR SURVEILLANCE

Bernard, Walter J., Bodenseewerk Geraetetechnik G.m.b.H., Germany; Systems Concepts for Integrated Air Defense of Multinational Mobile Crisis Reaction Forces; March 2001, pp. 2-1 - 2-13; In

English; See also 20010035146; Original contains color illustrations; Copyright Waived; Avail: CASI; A03, Hardcopy

A new approach to ground-based air surveillance will be outlined. This concept makes use of passive electrooptical sensors for panoramic surveillance in silent mode. Based upon infra-red Focal Plane Array (FPA) detector technology this system is designed to scan the complete hemisphere with a high search frame rate. Surface as well as airborne threats will be detected, tracked and classified with high probability of detection. As opposed to Infra-Red Search and Track (IRST) systems known so far, this new system approach uses a laser range finder to verify its alarms, once these have been pre-classified. With this additional verification process, which provides 3-dimensional target trajectories, the system's False Alarm Rate (FAR) is improved considerably. A powerful signal processing is running in real-time at the system's high search frame rate. Accurate target designation is possible with low data latency to perform fire control for an associated weapon System. Though designed for stand-alone tactical reconnaissance, this system can be interfaced fluidly with long-range radar surveillance systems to use cueing information from every area of the electromagnetic spectrum. Under contract to the German Ministry of Defense (MoD), an Advanced Technology Demonstrator (ATD) of such a silent-mode air surveillance system has been built and field-tested.

Author

Air Defense; Space Surveillance (Ground Based); Aerial Reconnaissance; Warning Systems; Weapon Systems

20010035148 Defence Evaluation Research Agency, Farnborough, UK

UK SOFT VERTICAL LAUNCH - A FLEXIBLE SOLUTION TO AN INTEGRAL CONCEPT FOR GROUND & NAVAL AIR DEFENCE

Titchener, P. E., Defence Evaluation Research Agency, UK; Veitch, A. J., Matra BAe Dynamics, UK; Systems Concepts for Integrated Air Defense of Multinational Mobile Crisis Reaction Forces; March 2001, pp. 3-1 - 3-14; In English; See also 20010035146; Original contains color illustrations; Copyright Waived; Avail: CASI; A03, Hardcopy

The paper describes the need for versatile and flexible systems in supporting Crisis Reaction Forces, and the role that soft vertical launch can play in meeting that need. The concept of operation is described together with the configuration and results of a demonstration program of live firings. Plans for continued development are outlined as is the vision for future operation.

Author

Vertical Takeoff Aircraft; Research Aircraft; Air Defense; Defense Program; United Kingdom

20010035149 Defence Evaluation Research Agency, Air C3I Group, Malvern, UK

AIRSPACE SURVEILLANCE FOR AIR BATTLE MANAGEMENT

Pearson, A. G., Defence Evaluation Research Agency, UK; Rocca, S. J., Defence Evaluation Research Agency, UK; Systems Concepts for Integrated Air Defense of Multinational Mobile Crisis Reaction Forces; March 2001, pp. 4-1 - 4-12; In English; See also 20010035146; Copyright Waived; Avail: CASI; A03, Hardcopy

Winning the air battle will be crucial in any future military campaign. Gaining the ability to use the air to our own ends, while denying its use to the enemy, requires adequate weapons, command and control (C2), communication and information systems (CIS) and sensors. In particular, air defence requires the support of airspace surveillance sensors - which is the topic of this paper. This paper focuses on the future requirements for airspace surveillance (to support the management of the air battle), some of the options for future surveillance sensors and how they contribute to meeting the requirement.

Author

Airspace; Surveillance; Target Acquisition; Target Recognition; Tracking (Position)

20010035150 Academy of Sciences of the Ukraine, Inst. of Mathematical Machines and Systems, Kiev, Ukraine

BASIC DISTRIBUTED CONTROL MODEL AND TECHNOLOGY FOR MOBILE CRISIS REACTION FORCES AND THEIR UNITED AIR DEFENSE

Sapaty, Peter S., Academy of Sciences of the Ukraine, Ukraine; Systems Concepts for Integrated Air Defense of Multinational Mobile Crisis Reaction Forces; March 2001, pp. 5-1 - 5-20; In English; See also 20010035146; Financial Sponsored in part by Advanced Systems Inst. in Vancouver; Copyright Waived; Avail: CASI; A03, Hardcopy

The paper investigates the use of the distributed processing and control model and technology, WAVE, operating in open computer networks and providing integral solutions of complex problems on a high semantic level, for a variety of system organization and management levels and tasks in relation to the mobile Crisis Reaction Forces and their integrated air defense. The technology hides most of traditional communication and organization routines like message passing, intelligent agents, mobile agents, remote procedure calls, remote method invocation, distributed object brokers, etc., within the system implementation, allowing application programs to be extremely powerful and compact. Based on a free migration of cooperative program code in both physical and virtual worlds and parallel spatial matching of the systems navigated, while creating and modifying the systems themselves, the technology allows for an unlimited scaling, and works equally well with any number of computers and any network topologies, which may be loose, dynamic, and open.

Author

Active Control; Control Theory; Distributed Parameter Systems

20010035151 Defence Evaluation Research Agency, Airspace management Systems Dept., Malvern, UK

FUTURE SHORT RANGE GROUND-BASED AIR DEFENCE: SYSTEM DRIVERS, CHARACTERISTICS AND ARCHITECTURES

Hutchings, P. J., Defence Evaluation Research Agency, UK; Street, N. J., Defence Evaluation Research Agency, UK; Systems Concepts for Integrated Air Defense of Multinational Mobile Crisis Reaction Forces; March 2001, pp. 6-1 - 6-19; In English; See also 20010035146; Original contains color illustrations; Copyright Waived; Avail: CASI; A03, Hardcopy

The aim of this paper is to describe how ground-based air defense concepts for the timeframe beyond 2015 may be synthesized from an assessment of the operational drivers and the technological factors, to produce robust modular concepts applicable to both warfighting and peach support regimes.

Derived from text

Space Surveillance (Ground Based); Air Defense

20010035152 George Mason Univ., Fairfax, VA USA

AN ARCHITECTURE FOR EFFECTS BASED COURSE OF ACTION DEVELOPMENT

Levis, Alexander H., George Mason Univ., USA; Systems Concepts for Integrated Air Defense of Multinational Mobile Crisis Reaction Forces; March 2001, pp. 7-1 - 7-10; In English; See also 20010035146; Original contains color illustrations

Contract(s)/Grant(s): N00014-00-1-0267; F49620-95-0134;

Copyright Waived; Avail: CASI; A02, Hardcopy

A prototype system to assist in developing Courses of Action and evaluating them with respect to the effects they are expected to achieve has been developed and is called CAESAR II/EB. The key components of the system are an influence net modeler and an executable model generator and simulator. The executable model is exercised using the plan that is derived from the selected Course of Action and the probabilities of achieving the desired effects are calculated. The architecture of CAESAR II/EB is presented and an illustrative example is used to show its operation.

Author

Prototypes; Network Synthesis; Architecture (Computers)

20010035153 Physics and Electronics Lab. TNO, The Hague, Netherlands

ON MODULARITY IN (V)SHORAD AIR DEFENSE

vanderVeen, E. M., Physics and Electronics Lab. TNO, Netherlands; Systems Concepts for Integrated Air Defense of Multinational Mobile Crisis Reaction Forces; March 2001, pp. 8-1 - 8-8; In English; See also 20010035146; Original contains color illustration; Copyright Waived; Avail: CASI; A02, Hardcopy

This paper addresses the concept of modularity in the context of (V)Shorads Air Defence. Modularity is a technical concept that provides improved operational flexibility to (V)Shorad systems. Such improved flexibility is specifically relevant to mobile crisis reaction

forces. The discussion is largely qualitative and descriptive, given the premature state of modular technology in defence. The discussion is also largely applicable beyond air defense systems. In this paper, it will be argued that modularity as a concept indeed addresses many of the problems facing mobile air defence today. It will also be made clear that there are serious restrictions and drawbacks to modularity. Further, it will be made credible that modularity is not a binary characteristic but a gradual one. This immediately raises the question how much modularity is required for what application, Thus, the paper will provide fundamental insight into the use of modularity in mobile air defense.
Author
Modularity; Air Defense; Surveillance; Tracking (Position)

20010035154 Norwegian Defence Research Establishment, Forsvarets Forsknings Inst., Kjeller, Norway
ESM-SENSORS FOR TACTICAL INFORMATION IN AIR DEFENCE SYSTEMS
Smestad, T., Norwegian Defence Research Establishment, Norway; Ohra, H., Norwegian Defence Research Establishment, Norway; Knapskog, A., Norwegian Defence Research Establishment, Norway; Systems Concepts for Integrated Air Defense of Multinational Mobile Crisis Reaction Forces; March 2001, pp. 9-1 - 9-14; In English; See also 20010035146; Original contains color illustrations; Copyright Waived; Avail: CASI; A03, Hardcopy

The main purpose of this paper is to inspire investigation efforts in clarifying whether ESM-sensors can become components of a cost-effective Integrated Air Defence System for an International Reaction Force, as we think that the potential of ESM-sensors in air defence is not yet fully recognized and analysed. The planning and conducting of air attacks with today's and tomorrow's technology seem to increasingly make use of electromagnetic emissions from airborne platforms. ESM-sensors can pick up these emissions; such sensors are likely to become more available due to the current technical development. The paper tries to enlighten the applicability of ESM-sensors in Air Defence Systems by presenting and discussing the different types of information they supply. An analysis of position accuracy is presented. Some principles for integrating ESM-sensors in a radar-based Air Defence System are suggested.
Author
Tacan; Tactics; Military Operations; Information Systems; Air Defense

20010035155 DaimlerChrysler Aerospace A.G., Airborne Systems Div., Ulm, Germany
MULTI-SENSOR-INTEGRATION CONCEPT FOR AIRBORNE SURVEILLANCE APPLICATIONS
Winkler, R. G., DaimlerChrysler Aerospace A.G., Germany; Wacker, U., DaimlerChrysler Aerospace A.G., Germany; Bantle, G., DaimlerChrysler Aerospace A.G., Germany; Schmidt, H., DaimlerChrysler Aerospace A.G., Germany; Systems Concepts for Integrated Air Defense of Multinational Mobile Crisis Reaction Forces; March 2001, pp. 10-1 - 10-6; In English; See also 20010035146; Original contains color illustration; Copyright Waived; Avail: CASI; A02, Hardcopy

Modem airborne surveillance systems have to cope with an immense number of inputs from real wanted and unwanted ground, maritime and/or airborne targets as well as correlated clutter. This causes significant challenges for tracking, classification, and identification of the detected objects. A state of the art multisensor integration (MSI) system calls for real-time integration of all available information pertaining to a real world object, in particular, geometric, kinematic, and signature data. The MSI system provide by Daimler-Chrysler Aerospace yields improved tracking quality and performs automatic identification of targets. The multi-sensor integration system processes data of various sensors, e.g., primary surveillance radar, secondary surveillance radar (IFF), data of passive electronic support measurements (ESM), acoustic sensor systems, crosstold data of Link-11 and Link-16 etc.. Based upon these data, the system will perform two tasks: Multi-sensor tracking and multi-sensor identification. New tracks will be initiated automatically based upon data input from active or passive sensors, respectively. State of the art multi-model technology is used. It guarantees optimal track stability under various maneuver conditions. In the correlation function, either an improved nearest neighbor algorithm or the advanced multi-hypothesis concepts are applied.. ESM reports from tactical data links and specific sensors are used to perform multi-sensor cooperative passive tracking. The multi-sensor identification system (MSI) is capable to identify air, surface, and ground tracks. It will operate fully automatically using all available data from all sensors as well as derived and background information depending on the confidence which is associated with the particular source. The system is able to handle various identification schemes in parallel. The automatic identification process will evaluate all available identification information for every MSI track using 'identification indicators'. The identification indicators will be combined to yield a track identity using an artificial intelligence (AI) supported combination process. Both, the MSI tracking and MSI identification functions can be controlled by mission data which are provided at mission startup or at any time during the mission.
Author
Surveillance Radar; Multisensor Applications; Real Time Operation; Iff Systems (Identification); Aerial Reconnaissance

20010035156 Pilkington Optronics, Business Development Manager, Staines, UK
OPTRONICS IN INTEGRATED AIR DEFENCE
Hoyle, R. D., Pilkington Optronics, UK; Systems Concepts for Integrated Air Defense of Multinational Mobile Crisis Reaction Forces; March 2001, pp. 12-1 - 12-11; In English; See also 20010035146; Original contains color illustrations; Copyright Waived; Avail: CASI; A03, Hardcopy

The aim of this paper is to review the use of Optronic sensors in Integrated Air Defence Systems, concentrating mostly on Infra-Red Search and Track (IRST) sensors. Optronic sensors are used today in Very SHOrt Range Air Defence (VSHORAD) and SHOrt Range Air Defence (SHORAD) weapon systems. Their operating range is typically 10 km or more, and they are particularly useful against low level targets. Optronic sensors are 'line of sight' sensors whose range performance is dependent upon the signal level emitted by the target (its signature) and the absorption of that signal by the atmosphere between the target and the sensor.
Derived from text
Air Defense; Infrared Tracking; Visual Perception; Weapon Systems

20010035157 Bodenseewerk Geraetetechnik G.m.b.H., Ueberlingen, Germany
DISTRIBUTION OF INTELLIGENCE IN AIRBORNE AIR-DEFENSE MISSION SYSTEMS
Krogmann, U., Bodenseewerk Geraetetechnik G.m.b.H., Germany; Systems Concepts for Integrated Air Defense of Multinational Mobile Crisis Reaction Forces; March 2001, pp. 13-1 - 13-10; In English; See also 20010035146; Original contains color illustrations; Copyright Waived; Avail: CASI; A02, Hardcopy

This paper addresses the distribution of intelligence, knowledge and learning capability among the main system elements. The enabling technologies are briefly introduced and the overall and subsystem structures are presented. In this context functional intelligence is integrated into the weapon system (air-air missile) yielding a considerable level of autonomy. This is complemented by a missile mission unit as part of the mission avionics which intelligently supports the pilot taking into account the new capabilities of the weapon system. Altogether this leads to improved efficiency and efficacy as well as extended functionalities of the air defense system. The system evolves with the learning capabilities of the intelligent elements starting with initial knowledge and by learning from experience, thus improving automatically. To gain experience in a variety of situations, applications and missions, training can be performed applying advanced embedded simulation and including virtual reality. Of course, also ACMI-type training is possible utilizing new range independent air combat training and debriefing systems.
Derived from text
Air Defense; Intelligence; Weapon Systems; Education

20010035158 Defence Evaluation Research Agency, Malvern, UK
REQUIREMENTS CAPTURE AND ANALYSIS FOR A DECISION-AIDING APPLICATION
Smalley, J. P. A., Defence Evaluation Research Agency, UK; Systems Concepts for Integrated Air Defense of Multinational Mobile Crisis Reaction Forces; March 2001, pp. 14-1 - 14-9; In English; See also 20010035146; Copyright Waived; Avail: CASI; A02, Hardcopy

This paper is about human factors integration, and providing information displays to match the operators' requirements . It addresses Man-Machine Interfaces and visualisation techniques. It will

describe a method of requirements capture that translated into highly acceptable and very effective information displays.
Derived from text
Human Factors Engineering; Man Machine Systems; Display Devices

20010035159 SPOTI, DSP, Issy- les- Moulineaux, France
INTEROPERABILITY MODELING OF THE C4ISR SYSTEMS *[LA MODELISATION DE L'INTEROPERABILITE DES SYSTEMES DE COMMANDEMENT]*
Bares, Michel, SPOTI, France; Systems Concepts for Integrated Air Defense of Multinational Mobile Crisis Reaction Forces; March 2001, pp. 16-1 - 16-16; In English; In French; See also 20010035146; Copyright Waived; Avail: CASI; A03, Hardcopy

Nowadays, as soon as a crisis or a small conflict is emerging throughout the world, coalitions of << responsible > > nations are formed in order to solve it. The expected finality is to aim for an increased efficiency by coordinating their military means and technical systems. In merging these systems, we have to cope with a major problem, which is to make heterogeneous systems cooperate. This heterogeneity, inherent to national design and applications concepts, generates big deficiencies at the interoperability level. Since the solution of making gangways is not easily and reasonably generalized, the right thing to do is to provide all systems (entering in a coalition) with interoperability mechanisms. In this paper, we propose a formal approach which is relying on three main concepts : openness structure of a federation of systems, interoperability space with the definition of an interoperability matrix, intercooperability domain in which we are able to define parameters that allow us to assess interoperability.
Author
Operating Systems (Computers); Heterogeneity; Distributed Parameter Systems; Knowledge Based Systems

20010035160 Terma Elektronisk Industri A/S, Marketing and Sales Manager, Lystrup, Denmark
MOBILE AND NETTED AIR DEFENCE SYSTEMS
Iversen, Thomas F., Terma Elektronisk Industri A/S, Denmark; Systems Concepts for Integrated Air Defense of Multinational Mobile Crisis Reaction Forces; March 2001, pp. 17-1 - 17-8; In English; See also 20010035146; Original contains color illustrations; Copyright Waived; Avail: CASI; A02, Hardcopy

This paper describes a sensor- and weapon independent co-ordination and communication concept for use in coming generations of mobile SHORAD and medium range air defence systems. Actually, the proposed concept will handle most known weapon systems. The presented system generates and maintains a ratified total air picture from available track information, whether from system specific radar sensors or from system external sensors via data links. Airspace Control Means, and their effect on Threat Evaluation and Weapon Allocation operations, are totally integrated in the system, allowing full and safe use of friendly aircraft during air defence operations. Powerful training- and simulation software allow fully synchronised system training sessions from classroom equipment or from any operator position in the system.
Derived from text
Air Defense; Weapon Systems; Data Links; Computerized Simulation; Airspace

20010035161 Instituto Nacional de Tecnica Aeroespacial, Remote Sensing Lab., Madrid, Spain
VULNERABILITY ASSESSMENT OF SURFACE-TO-AIR MISSILE SYSTEMS
Barreiros, M., Instituto Nacional de Tecnica Aeroespacial, Spain; Systems Concepts for Integrated Air Defense of Multinational Mobile Crisis Reaction Forces; March 2001, pp. 18-1 - 18-9; In English; See also 20010035146; Original contains color illustrations; Copyright Waived; Avail: CASI; A02, Hardcopy

The susceptibility of a surface-to-air missile system to surveillance and target acquisition sensors operating in the infrared wavebands of 3-5 and 8-12 microns has been analyzed by testing. The trials were carried out accordingly STANAG 4418 and AVTP Trial series 05, with and without camouflage systems installed. It is described the planning and execution of the tests, the equipment employed and the data analysis procedure. The effectiveness of the camouflage systems to reduce the thermal signature, has been assessed using the acceptance criteria established on STANAG 4418. Some examples are discussed.
Author
Surface To Air Missiles; Vulnerability; Surveillance; Target Acquisition; Missile Systems; Infrared Radiation

20010035162 DELS Scientific and Technical Centre, Minsk, Belarus
ASSESSMENT OF THE EFFECTIVENESS OF THE INTEGRATED AIR DEFENSE OF MULTINATIONAL PEACEKEEPING CRISIS REACTION FORCES
Fedulov, Y., DELS Scientific and Technical Centre, Belarus; Tereshko, S., DELS Scientific and Technical Centre, Belarus; Systems Concepts for Integrated Air Defense of Multinational Mobile Crisis Reaction Forces; March 2001, pp. 19-1 - 19-10; In English; See also 20010035146; Copyright Waived; Avail: CASI; A02, Hardcopy

MPF AD should be organised in accordance with the UN mandate (UN Security Council Resolution). Among the main objectives assigned to MPF AD are the following: 1) Control over airspace in the peacekeeping regions and in the air safety zone (ASZ); 20 Coordination of airspace use; and 3)Organization of cover for MPF and for the units they protect. Control over the airspace in peacekeeping regions is a complicated organizational and technical goal. The complicated character of the goal is due to the requirement for the guaranteed all-altitude control in the zone under MPF AD jurisdiction and also the need for 24hr radar surveillance and the extremely limited time frame for reaction to possible attacks in the airspace. In some cases the multinationality of the peacekeeping forces is also a significant factor.
Derived from text
Air Defense; Airspace; Flight Safety; Aircraft Safety

20010035164 INDRA Espacio, Madrid, Spain
A WAY TO CONTROL MEDIUM AND LOW RANGE WEAPONS SYSTEMS IN AN AIR DEFENSE ARTILLERY COMMAND AND CONTROL SYSTEM
Pantaleon, Juan Diez, INDRA Espacio, Spain; Systems Concepts for Integrated Air Defense of Multinational Mobile Crisis Reaction Forces; March 2001, pp. 20-1 - 20-10; In English; See also 20010035146; Original contains color illustration; Copyright Waived; Avail: CASI; A02, Hardcopy

When an Air Defense Artillery (ADA) commander receive the order to defend an area o high value point he also receives the list of ADA units that can be employed. He will never receive the appropriate resources he would like to have. The most common problem that arises to the ADA commander is to manage different kinds of weapons systems (medium, short and very short ranges) given for air defense purposes. To integrate subordinate Fire Direction Centers (FDC,s) and the various weapons systems in a single ADA Command and Control (C2) Fire Direction Center (FDC) is a real problem. Functions providing control of weapons require some ideas to be presented in this paper. The national weapons systems integration can be easily managed. Non national resources could be integrated if some software and communication problems could be solved.
Derived from text
Air Defense; Weapon Systems; Command And Control; Systems Integration

20010047065 Defence Evaluation Research Agency, Pattern and Information Processing, Malvern, UK
CONVOY PLANNING IN A DIGITIZED BATTLESPACE
Harrison, S. A., Defence Evaluation Research Agency, UK; New Information Processing Techniques for Military Systems; April 2001, pp. 22-1 - 22-10; In English; See also 20010047042; Copyright Waived; Avail: CASI; A02, Hardcopy

In this paper we present a formal specification of a convoy planning problem in terms of a time-space network. We apply advanced heuristic techniques to this model and evaluate the approach on a number of realistic scenarios based on the UK MoD's Scenario Advisory Group (SAG) settings. The results demonstrate that the method described is an effective approach for solving practical instances of convoy planning. We also describe an automated planning tool that has been developed, based on the techniques described in this paper and which has been used to plan simulated movements of realistic size. The tool runs on a laptop, is

fast and reduces planning time from man-hours to a few seconds. The value of the techniques described in this paper is not limited to this one application. Hence, we review a representative set of military applications where we expect these techniques to be equally beneficial.
Derived from text
Planning; Software Development Tools; Personal Computers; Computer Programs

20010047066 Physics and Electronics Lab. TNO, Maritime Command and Control, The Hague, Netherlands
AN INFORMATION FILTERING AND CONTROL SYSTEM TO IMPROVE THE DECISION MAKING PROCESS WITHIN FUTURE COMMAND INFORMATION CENTRES
Maas, Hans L. M. M., Physics and Electronics Lab. TNO, Netherlands; Wynia, Sikke Jan, Physics and Electronics Lab. TNO, Netherlands; Sorensen, Morten Heine, Terma Elektronisk Industri A/S, Denmark; Houtsma, Maurice A. W., Hollandse Signaalapparaten N.V., Netherlands; New Information Processing Techniques for Military Systems; April 2001, pp. 23-1 - 23-13; In English; See also 20010047042; Original contains color illustrations; Copyright Waived; Avail: CASI; A03, Hardcopy

This paper describes the achieved research results within several national and international C2 and information-management projects to develop concepts for balancing the information push with an operator's information need in order to meet the requirement to avoid/suppress information overload situations. The paper starts with an analysis and syntheses of the information overload problem. A model is used to describe the causes and the consequences of information overload on the operator's behaviour and performance in a command information centre of naval vessels. Research has shown that an increasing amount of time is needed for gathering and discriminating relevant information. from the actual information push while less time is left for analysing the relevant information in more details and taking correct and original decisions. Information overload is seen as a serious threat for the quality and performance of mission execution. The blueprint for an adaptive information management support concept is based on merging several information management support approaches: (1). Approaches to estimate and/or measure and control the operator's information overload; (2). Information exchange concepts; and (3). Information handling within several kind of tasks: Skill based, rule-based and knowledge-based tasks. Based on the complexity of the problem, an information management concept is discussed to control and filter the information flows adaptively for skill and rule dominated tasks.
Derived from text
Information Flow; Information Management; Decision Making

20010047067 Industrieanlagen-Betriebsgesellschaft m.b.H., Ottobrunn, Germany
COMPREHENSIVE APPROACH TO IMPROVE IDENTIFICATION CAPABILITIES
Stroscher, Christoph, Industrieanlagen-Betriebsgesellschaft m.b.H., Germany; Schneider, Frank, Industrieanlagen-Betriebsgesellschaft m.b.H., Germany; New Information Processing Techniques for Military Systems; April 2001, pp. 24-1 - 24-4; In English; See also 20010047042; Original contains color illustrations; Copyright Waived; Avail: CASI; A01, Hardcopy

The process and the prototype presented here, are dedicated to improve the overall identification capability. This is aimed to be achieved by making available all identification related information, - i.e. local and remote data -, fusing and interpreting them, and supporting the decision process by offering a recommendation together with all explanation that might be desired. The paper presents a solution that uses the Identification Data Combining Process (IDCP) according to draft STANAG 4162 as baseline. The prototype, assisting in identifying airborne objects, is the result of an experimental system using simulated as well as live data in a German Control and Reporting Centre (CRC).
Author
Computer Techniques; Improvement; Identifying; Data Transfer (Computers); Multisensor Fusion; Decision Support Systems

20010047070 Naval Research Lab., Advanced Information Technology, Washington, DC USA
BARS: BATTLEFIELD AUGMENTED REALITY SYSTEM
Julier, Simon, Naval Research Lab., USA; Baillot, Yohan, Naval Research Lab., USA; Lanzagorta, Marco, Naval Research Lab., USA; Brown, Dennis, Naval Research Lab., USA; Rosenblum, Lawrence, Naval Research Lab., USA; New Information Processing Techniques for Military Systems; April 2001, pp. 27-1 - 27-7; In English; See also 20010047042; Original contains color illustrations; Copyright Waived; Avail: CASI; A02, Hardcopy

Many future military operations are expected to occur in urban environments. These complex, 3D battlefields are extremely demanding and introduce many challenges to the dismounted warfighter. These include limited visibility, lack of familiarity with the environment, sniper threats, concealment of enemy forces, ineffective communications, and a general problem of locating and identifying enemy and friendly forces. Better situational awareness is required for effective operation in the urban environment, We believe that situational awareness needs cannot be met using traditional approaches such as radios, maps and handheld displays and more powerful display paradigms are needed, We are researching mobile augmented reality (AR) through the development of the Battlefield Augmented Reality System (BARS) in collaboration with Columbia University. The system consists of a wearable computer, a wireless network system and a tracked see-through Head Mounted Display (HMD). The user's perception of the environment is enhanced by superimposing graphics onto the user's field of view. The graphics are registered (aligned) with the actual environment. For example, an augmented view of a building could include a wireframe plan of its interior, icons to represent reported locations of snipers and the names of adjacent streets. This paper describes the major challenges and the current implementation of BARS. In particular, we stress the need for high value graphical displays which provide the relevant, critical information for a user's current context. These displays should be precisely registered with the environment. There are three major research areas. First, an information distribution system is being developed which distributes to a mobile user only a relevant subset of the common tactical picture. Second, to prevent information overload, we have developed an intelligent filter which selects and prioritizes the type of augmented information which is needed by a user's mission profile. Finally, high performance tracking and calibration systems are required to achieve accurate registration. We describe a general calibration framework that allows precision registration to be carried out in the field.
Author
Military Operations; Information Systems; Computer Networks; Field Of View

20010071193 Research and Technology Organization, Systems Concepts and Integration Panel, Neuilly-sur-Seine, France
TECHNOLOGIES FOR FUTURE PRECISION STRIKE MISSILE SYSTEMS *[LES TECHNOLOGIES DES FUTURS SYSTEMES DE MISSILES POUR FRAPPE DE PRECISION]*
Technologies for Future Precision Strike Missile Systems; July 2001; 148p; In English; 18-19 Jun. 2001; 21-22 Jun. 2001; 25-26 Jun. 2001; 28-29 Jun. 2001, Tbilisi, Bucharest, Madrid, Stockholm, Georgia, Romania, Spain, Sweden; See also 20010071194 through 20010071203; Original contains color illustrations; CD-ROM contains full text document in PDF format
Report No.(s): RTO-EN-018; AC/323(SCI-087-bis)TP/37; ISBN 92-837-1070-3; Copyright Waived; Avail: CASI; C01, CD-ROM; A07, Hardcopy; A02, Microfiche

This lecture series addressed recent advances in the state-of-the-art for precision strike missile systems. Emerging technologies that were addressed in the lecture series included: (1) Mission planning technology. Assessments included off-board sensor integration, near-real-time mission planning, flight altitude, terrain following, and missile data links for in-flight targeting; (2) Missile aeromechanics technology. Assessments included hypersonic airframes, low cost/high temperature structure, and ramjet propulsion; (3) Guidance and control technology. An overview of existing guidance and control was given. Assessments included precision guidance and optimal guidance laws; (4) Missile GPS/INS sensor technology. Assessments included low cost INS and GPS/INS integration; (5) Missile design technology. An overview of the missile design process was given. Assessments included computer programs and electronic spreadsheets for conceptual design and missile deign criteria; (6) Seeker technology. Assessments included active and passive imaging infrared and radar seekers; (7) Missile/aircraft integration technology. Assessments included high firepower weapon concepts,

reduced observables, and insensitive munitions; and (8) Simulation/validation technology. Assessments included hardware-in-the-loop and design validation.
Author
Missiles; Mission Planning; Aerodynamics; Missile Systems; Missile Design; Missile Control

20010071194 Swedish Defence Research Establishment, Stockholm, Sweden
MISSION PLANNING TECHNOLOGY
Berglund, Erik, Swedish Defence Research Establishment, Sweden; Technologies for Future Precision Strike Missile Systems; July 2001, pp. 1-1 - 1-8; In English; See also 20010071193; Original contains color illustrations; Copyright Waived; Avail: CASI; A02, Hardcopy

Some important aspects of mission planning are briefly outlined. More detailed discussions concern the missile's ability to avoid enemy air defences and to resist point defence. Both the option of using low observables technology and the option of using terrain masking at low altitude are found to be viable techniques to avoid enemy air defences. It is argued that it is useful for the missile to employ countermeasures, such as manoeuvres, in the final kilometres. The new threats to missiles posed by Global Positioning System jamming and anti-sensor lasers are briefly outlined. A short discussion on the possibilities for mission planning opened up by the progress in information technology is included.
Author
Missiles; Mission Planning; Air Defense

20010071195 Georgia Inst. of Tech., Aerospace Systems Design Lab., Atlanta, GA USA
TECHNOLOGIES FOR FUTURE PRECISION STRIKE MISSILE SYSTEMS: MISSILE AEROMECHANICS TECHNOLOGY
Fleeman, Eugene L., Georgia Inst. of Tech., USA; Technologies for Future Precision Strike Missile Systems; July 2001, pp. 2-1 - 2-19; In English; See also 20010071193; Original contains color illustrations; Copyright Waived; Avail: CASI; A03, Hardcopy

This paper provides an assessment of the state-of-the-art of new aeromechanics technologies for future precision strike missile systems. The aeromechanics technologies are grouped into specific discussion areas of aerodynamics, propulsion, and airframe materials technologies. Technologies that are addressed in this paper are: (1) Missile aerodynamics technologies. Assessments include aerodynamic configuration shaping, lattice tail control, split canard control, forward swept surfaces, bank-to-turn maneuvering, and flight trajectory shaping; (2) Missile propulsion technologies. Assessments include supersonic air breathing propulsion, high temperature combustors, low drag ramjet inlets, ramjet inlet/airframe integration, higher density fuels, rocket motor thrust magnitude control, high thrust motor, and reaction jet control; and (3) Missile airframe materials technologies. Assessments include hypersonic structure materials, composite structure materials, hypersonic insulation materials, multi-spectral domes, and reduced parts count structure.
Author
Aerodynamics; Missiles; Missile Systems; Propulsion; Airframe Materials

20010071196 Swedish Defence Research Establishment, Stockholm, Sweden
GUIDANCE AND CONTROL TECHNOLOGY
Berglund, Erik, Swedish Defence Research Establishment, Sweden; Technologies for Future Precision Strike Missile Systems; July 2001, pp. 3-1 - 3-15; In English; See also 20010071193; Copyright Waived; Avail: CASI; A03, Hardcopy

The fundamental ideas and the basic mathematics of the most common missile guidance laws are outlined. Rules of thumb for the required lateral acceleration for the different guidance laws are given. A brief summary of flight mechanics is given. The pitch axis control is treated and the dynamic properties are identified. Design of the autopilot for the inner loop using modern methods of controller design is briefly outlined.
Author
Dynamic Characteristics; Flight Mechanics; Missile Control

20010071197 Raytheon Co., Alpharetta, GA USA
INS/GPS FOR STRIKE WARFARE BEYOND THE YEAR 2000
Licata, William H., Raytheon Co., USA; Technologies for Future Precision Strike Missile Systems; July 2001, pp. 4-1 - 4-10; In English; See also 20010071193; Original contains color illustrations; Copyright Waived; Avail: CASI; A02, Hardcopy

This paper presents a review of Inertial Navigation Systems (INS) and the Global Positioning System (GPS) as a key technology for Strike Warfare beyond the Year 2000. The paper reviews the functionality that INS/GPS provides the Missile Guidance, Navigation and Control (GNC) designer plus the requirements associated with this functionality. Existing systems on the market are reviewed and new systems that can be expected to enter the market in the 2000 to 2010 time frame are discussed. System issues associated with the use of this hardware and trends in system integration methods are reviewed. The paper concludes with a discussion of the likely future uses of INS/GPS in precision strike missiles.
Author
Global Positioning System; Inertial Navigation; Missile Control; Warfare

20010071198 Georgia Inst. of Tech., Aerospace Systems Design Lab., Atlanta, GA USA
TECHNOLOGIES FOR FUTURE PRECISION STRIKE MISSILE SYSTEMS: MISSILE DESIGN TECHNOLOGY
Fleeman, Eugene L., Georgia Inst. of Tech., USA; Technologies for Future Precision Strike Missile Systems; July 2001, pp. 5-1 - 5-15; In English; See also 20010071193; Original contains color illustrations; Copyright Waived; Avail: CASI; A03, Hardcopy

This paper provides an assessment of the state-of-the-art and considerations of missile design technology for future precision strike missile systems. Benefits of missile design technology include new advanced missile concepts, identification of driving parameters, balanced subsystems, incorporation of new technologies, light weight/low cost missiles, and launch platform compatibility. The paper discusses the missile design process, presents examples of simulation and spreadsheet conceptual design computer programs, provides missile configuration design criteria, and lists references that are applicable to missile design technology.
Author
Missile Systems; Design Analysis; Missile Design

20010071199 Raytheon Co., Alpharetta, GA USA
MISSILE SEEKERS FOR STRIKE WARFARE BEYOND THE YEAR 2000
Licata, William H., Raytheon Co., USA; Technologies for Future Precision Strike Missile Systems; July 2001, pp. 6-1 - 6-12; In English; See also 20010071193; Original contains color illustrations; Copyright Waived; Avail: CASI; A03, Hardcopy

The goal of this paper is to explore emerging post Cold War missile seeker requirements that will lead to new seeker procurements in the year 2000+. These requirements are compared to existing missile seeker products to show where technology deficiencies exist. A projection is made of what seekers will be deployed in the near future to fill important military missile user needs and where technology investments will be made to develop fully capable missile seekers. The orientation of the presentation is on missile seekers as a product and the functionality they provide the military user community. Therefore, the presentation discusses new functionality not included in seekers built in the 1900's because of technology limitations or lack of sufficient user requirements.
Author
Homing Devices; Missiles; Warfare; User Requirements

20010071200 Georgia Inst. of Tech., Aerospace Systems Design Lab., Atlanta, GA USA
TECHNOLOGIES FOR FUTURE PRECISION STRIKE MISSILE SYSTEMS: MISSILE/AIRCRAFT INTEGRATION
Fleeman, Eugene L., Georgia Inst. of Tech., USA; Technologies for Future Precision Strike Missile Systems; July 2001, pp. 7-1 - 7-17; In English; See also 20010071193; Original contains color illustrations; Copyright Waived; Avail: CASI; A03, Hardcopy

This paper provides an assessment of the state-of-the-art and design considerations of missile/aircraft integration for future precision strike missile systems. Benefits of missile/aircraft integration include compatibility with a broader range of aircraft carriage platforms, unrestricted carriage envelope, safe and accurate store separation, and enhanced survivability for the aircraft platform. Technologies and design considerations are grouped into the follow-

ing discussion areas: (1) Missile factor of safety compatibility. Assessments in this area include structural design factor of safety, carriage flight loads, and design specification of the carriage flight environment; (2) Missile carriage and launch compatibility. Assessments in this area include launch platform compatibility constraints, firepower, light weight logistics, launcher alternatives, compressed carriage, standard suspension requirements, and safe separation; and (3) Survivability (missile observables/insensitive munitions) compatibility. Assessments in this area include internal carriage, reduced observable plumes, and insensitive munitions.
Author
Carriages; Compatibility; Missile Systems; Structural Design

20010071201 Swedish Defence Research Establishment, Stockholm, Sweden
SIMULATION/DESIGN VALIDATION TECHNOLOGY
Berglund, Erik, Swedish Defence Research Establishment, Sweden; Technologies for Future Precision Strike Missile Systems; July 2001, pp. 8-1 - 8-7; In English; See also 20010071193; Copyright Waived; Avail: CASI; A02, Hardcopy

Simulation plays an increasingly important role in the development of new missile systems. This paper contains a brief overview of the various types of simulation models used in different phases of design and evaluation. The main emphasis is placed on trajectory simulation models. The usefulness of different trajectory models for different purposes is treated. A recommendation is to avoid using more complicated models than are required to address the problem of interest. The problem of using a very limited number of test firings to validate a highly complex model is mentioned.
Author
Missile Systems; Computerized Simulation; Systems Simulation; Missile Trajectories

20010071202 Raytheon Co., Alpharetta, GA USA
AUTOMATIC TARGET RECOGNITION (ATR) BEYOND THE YEAR 2000
Licata, William H., Raytheon Co., USA; Technologies for Future Precision Strike Missile Systems; July 2001, pp. 9-1 - 9-16; In English; See also 20010071193; Original contains color illustrations; Copyright Waived; Avail: CASI; A03, Hardcopy

The goal of this paper is to project those video or picture based Automatic Target Recognition (ATR) systems likely to enter military inventories and alter mission planning in the year 2000 and beyond. Therefore, this paper avoids a discussion of specific technical approaches and their relative merits that often leads into proprietary or classified discussions. An emphasis is placed on the attributes of ATR as a military product and the factors that will determine the success or failure of efforts to move them in large quantities into military inventories. Some suggestions will be given on how the time to market can be shortened and where video ATR systems will first appear on the post cold war battlefield.
Author
Target Recognition; Mission Planning; Video Data

20010071203 Georgia Inst. of Tech., Aerospace Systems Design Lab., Atlanta, GA USA
TECHNOLOGIES FOR FUTURE PRECISION STRIKE MISSILE SYSTEMS: INTRODUCTION/OVERVIEW
Fleeman, Eugene L., Georgia Inst. of Tech., USA; Technologies for Future Precision Strike Missile Systems; July 2001, pp. 1-1 - 1-12; In English; See also 20010071193; Original contains color illustrations; Copyright Waived; Avail: CASI; A03, Hardcopy

This report documents and updates the results of NATO Research and Technology Organization (RTO) lecture series number 221, entitled 'Technologies for Future Precision Strike Missile Systems'. The lecture series was conducted under the RTO Consultant and Exchange (C&E) Program as a two-day educational event. The lectures were first held March 23-24, 2000 in Atlanta Georgia USA, at the Georgia Institute of Technology. Following the lectures at Georgia Tech, the lectures were held April 3-4, 2000 in Turin, Italy and April 6-7, 2000 in Ankara, Turkey. Due to the interest in the lectures, they were reprised in 2001. Updated lectures were presented in Tbilisi, Georgia (18-19 June 2001), Bucharest, Romania (21-22 June 2001), Madrid, Spain (25-26 June 2001), and Stockholm, Sweden (28-29 June 2001). The primary purpose of the lecture series was the dissemination of state-of-the-art scientific and technical knowledge among a wide audience. The lecture series identified significant developments in the enabling technologies and provided examples of the advancements. It also addressed the challenging requirements in areas such as adverse weather capability, time critical targets, high kill probability, no collateral damage, high survivability light-weight expeditionary warfare weapons, and affordability. Emerging technologies for precision strike missile systems that were addressed in the lecture series included mission planning technology, missile aeromechanics technology, guidance and control technology, missile GPS/INS sensor technology, missile design technology, seeker technology, missile/aircraft integration technology, simulation/validation technology, and automatic target recognition technology.
Author
Lectures; Missile Systems; Missiles; Information Dissemination

20010072760 Defence Procurement Agency, Bristol, UK
UK FUTURE OFFENSIVE AIR SYSTEM (FOAS): FROM REQUIREMENTS TO OPERATION
Baker, P., Defence Procurement Agency, UK; Martin, K., Matra BAe Dynamics, UK; Page, I., Defence Evaluation Research Agency, UK; Smith, N., Defence Evaluation Research Agency, UK; The Second NATO Modelling and Simulation Conference; July 2001, pp. 24-1 - 24-15; In English; See also 20010072746; Original contains color illustrations; Copyright Waived; Avail: CASI; A03, Hardcopy

As Synthetic Environment (SE) technology continues to mature, a pattern is emerging for utilizing SEs. As part of the concept analysis stage of the Smart procurement cycle, the Future Offensive Air System (FOAS) Integrated Project Team (IPT) at the Defence Procurement Agency (DPA) has defined, developed and employed an SE to complement the more traditional analysis work required for submission to Initial Gate. A collaborative partnership has been established between DPA, the Defense Evaluation and Research Agency (DERA) and a number of Industry partners to design, implement and operate the FOAS SE. The primary aim has been to support the FOAS concept analysis for various force mixes. However, the SE has been designed with the deliberate intention of providing a re-usable facility for future investigations, and has drawn strongly from experience of many previous SE areas, such as the Air Defence SE (ADSE), Flashlamp and the Synthetic Theater of War (STOW) programs. In this context, the design of the SE employs a standards-based framework in accordance with the US High Level Architecture (HLA). The implementation of this SE has also been underpinned by the integration of commercial off-the-shelf software tools, aimed at addressing SE management and control issues. This paper provides a position statement on the development and use to date of the SE for FOAS analysis, and captures the lessons learned. Also discussed are the management processes used to define, implement and operate the SE, along with the potential for future FOAS use and for other SE programmes.
Author
Computerized Simulation; Environment Simulation; Air Defense

20010076838 Air Force Research Lab., Brooks AFB, TX USA
ALTITUDE DCS RESEARCH IN SUPPORT OF SPECIAL OPERATIONS FORCES (SOF)
Pilmanis, Andrew A., Air Force Research Lab., USA; Webb, James T., Air Force Research Lab., USA; Operational Medical Issues in Hypo- and Hyperbaric Conditions; June 2001, pp. 40-1 - 40-10; In English; See also 20010076799; Copyright Waived; Avail: CASI; A02, Hardcopy

The potential impact of altitude decompression sickness on special operations missions may manifest primarily in high altitude airdrop operations and operations using unpressurized aircraft such as AC-130 and the CV-22 Osprey. Research at AFRL, Brooks AFB on altitude DCS has for many years produced findings directly applicable to SOF mission scenarios. This paper summarizes three areas of research with current applicability. Complete publications are in preparation and the results presented here should be considered preliminary.
Author
Decompression Sickness; Military Operations

20020016348 Defence Research Establishment Ottawa, Ottawa, Ontario Canada
NETCENTRIC WARFARE FOR DYNAMIC COALITIONS: IMPLICATIONS FOR SECURE INTEROPERABILITY
McIntyre, Mark, Defence Research Establishment Ottawa, Canada; Flemming, Sherri, Defence Research Establishment Ottawa, Canada; Information Management Challenges in Achieving Coalition Interoperability; December 2001, pp. 21-1 - 21-12; In English; See also 20020016329; Original contains color illuatrations; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

The term network centric, or netcentric, warfare is commonly used in military literature to connote the future of military operations where timely and ubiquitous sharing of information among operational forces will lead to dramatic improvements in mission effectiveness. If this mode of operation is to be successfully employed in coalition operations, then particular attention must be paid to secure interchange of information among the coalition partners. In this paper, various modes of netcentric warfare are discussed and the implications of introducing information security at various levels are presented. In particular, the network quality-of-service requirements for the different netcentric modes are discussed with emphasis on the trade-offs that must be made when information security is an important consideration.
Author
Interoperability; Military Operations; International Cooperation; Information Systems

20020016352 Ministry of Defence, London, UK
COALITION REQUIREMENTS FOR SHARED SITUATIONAL AWARENESS
Stewart, James, Ministry of Defence, UK; Pierre, Leslie, Ballistic Missile Defense Organization, USA; Harrison, Clive, Defence Scientific Technology Lab., UK; Collinson, Alan, Collinson Systems Ltd., UK; Evans, Gordon, Vanguard Research, Inc., USA; Information Management Challenges in Achieving Coalition Interoperability; December 2001, pp. 25-1 - 25-6; In English; See also 20020016329; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

The U.S. Ballistic Missile Defense Organization (BMDO) and the UK Ministry of Defence, Directorate of Science (Ballistic Missile Defence) (MOD DSc(BMD)) have undertaken a series of three bilateral Policy-Military Seminars focusing on Theater Ballistic Missiles (TBM). Two additional seminars are being planned. This presentation describes the challenges that are the basis of these seminars, how they are conducted, their most important findings and, in particular, what these seminars have taught the sponsors about the requirements for shared situational awareness which, ultimately, forms the context to interpret the common operating picture.
Author
Ballistic Missiles; Missile Defense; International Cooperation; Interoperability; Situational Awareness

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ACOUSTICS

19990040732 Air Force Research Lab., Wright-Patterson AFB, OH USA
ACTIVE CONTROL OF WEAPON BAY ACOUSTICS
Shaw, Leonard, Air Force Research Lab., USA; Aircraft Weapon System Compatibility and Integration; April 1999, pp. 22-1 - 22-10; In English; See also 19990040714; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

To increase the range and payload of both existing and future aircraft, while maintaining or increasing mission survivability, weapons must be carried in low drag/low observable configurations. Existing external weapons carriage technology accounts for as much as 30% of total vehicle drag and prohibitive increases in radar signature. Internal weapons carriage solves signature issues, but substantially increases aircraft size while limiting weapon payloads to the size of weapon bays. New innovative and novel ways of both internal and external weapons carriage will be crucial to fighters of the next century. However, the new internal bays create a challenge to develop methods to suppress and control the internal flow induced acoustic environment in the weapons bay. The objective of the current wind tunnel test program was to define the baseline acoustic environment in a cavity and evaluate the effectiveness of active suppression concepts. The concepts consisted of leading edge oscillating flaps and leading edge pulsed fluidic actuation. Both concepts were evaluated for a range of parameters and the results indicate that either will successfully control the instabilities in the shear layer and thus suppress the flow induced acoustic environment in the cavity. The pulsed fluidic actuator was found to be more robust.
Author
Bays (Structural Units); Weapon Systems; Noise Reduction; Active Control; Internal Flow; Acoustics; Wind Tunnel Tests; Acoustic Excitation

20000020862 Ecole Centrale de Paris, Lab. EM2C, France
ADAPTIVE CONTROL OF AEROACOUSTIC INSTABILITIES WITH APPLICATION TO PROPULSION SYSTEMS
Mettenleiter, M., Ecole Centrale de Paris, France; Haile, E., Ecole Centrale de Paris, France; Candel, S., Ecole Centrale de Paris, France; Gas Turbine Engine Combustion, Emissions and Alternative Fuels; June 1999, pp. 39-1 - 39-13; In English; See also 20000020829; Copyright Waived; Avail: CASI; A03, Hardcopy; A06, Microfiche

This paper describes an experimental investigation of adaptive control algorithms applied to aeroacoustic instabilities. The study is carried out on a cold how experimental rig, designed to reproduce the essential features of acoustically coupled vortex shedding. This mechanism is responsible for thrust, oscillations in large segmented solid rocket motors. It, is also found in a wide variety of combustion instabilities. An adaptive control strategy is presented, with selected experimental results. These results show the feasibility of control. We then analyze the effect of the c controller on the instability mechanism, and propose improvements to the control strategy.
Author
Adaptive Control; Aeroacoustics; Propulsion; Solid Propellant Rocket Engines; Combustion; Controllers

20000089819 Research and Technology Organization, Human Factors and Medicine Panel, Neuilly-sur-Seine, France
DAMAGE RISK FROM IMPULSE NOISE *[LES RISQUES AUDITIFS ET EXTRA AUDITIFS DES BRUITS IMPULSIONNELS]*
September 2000; 84p; In English; 5-6 Jun. 2000; 15-16 Jun. 2000, MD, Meppen, USA, Germany; See also 20000089820 through 20000089826; CD-ROM contains full text document in PDF format Report No.(s): RTO-EN-11; AC/323(HFM)TP/31; ISBN 92-837-1042-8; Copyright Waived; Avail: CASI; A05, Hardcopy; A01, Microfiche; C01, CD-ROM

This publication comprises papers from an RTO Lecture Series on Damage Risk From Impulse Noise. High-level impulse noise (weapons noise) can cause auditory as well as non-auditory damage, which may limit combat effectiveness and may result in communication impairments as a consequence of noise-induced hearing loss. Recent research has shown that the present damage risk criteria have to be adjusted. This has major implications for the protective measures that have to be taken when using weapon systems. Protection equipment can be very effective when properly used, but everyday practice shows that the results in the field fall short of what could be achieved. In addition, hearing protection may interfere with communication. New developments in the design of hearing protectors: level dependent, active noise reduction show how the protection and communication requirements can be combined and satisfied. Educational programs, emphasizing the new developments, may help to improve the effectiveness of hearing conservation and reduce the number of non-auditory accidents. Topics covered by individual papers are: techniques and procedures for the measurement of impulse noise . a draft ANSI standard on auditory risk criteria, performance of hearing protectors, communication and localisation with hearing protectors, individual susceptibility to noise-induced hearing loss, new perspectives in the treatment of acute noise trauma, cost effectiveness of hearing conservation programmes, and non-auditory damage risk assessment for impulse noise.
Author
Active Control; Cost Effectiveness; Damage Assessment; Impulses; Noise Measurement; Noise Reduction; Protection

20000089820 Wehrtechnische Dienstelle fuer Waffen und Munition, Meppen, Germany
TECHNIQUES AND PROCEDURES FOR THE MEASUREMENT OF IMPULSE NOISE
Brinkman, Heinz H., Wehrtechnische Dienstelle fuer Waffen und Munition, Germany; Damage Risk from Impulse Noise; September 2000, pp. 1-1 - 1-13; In English; See also 20000089819; Copyright Waived; Avail: CASI; A03, Hardcopy

Criteria for the measurement of continuous sound have been agreed upon on an international level in the 'International Organization for Standardization'. These criteria have been promulgated as IS0 standards or recommendations. The different nations, however, disagree on the criteria for the measurement and evaluation of impulse noise. Impulse noise measurement alone cannot be seen as an end in itself, but rather as a tool in the determination of the risk to personnel and materiel resulting from the impulse noise which may be produced by a weapon or an explosion.
Author
Procedures; Noise Measurement; Acoustic Measurement

20000089821 Brueel, Bertrand and Johnson Acoustics, Provo, UT USA
NEW AUDITORY DAMAGE RISK CRITERIA AND STANDARD FOR IMPULSE NOISE
Johnson, Daniel L., Brueel, Bertrand and Johnson Acoustics, USA; Damage Risk from Impulse Noise; September 2000, pp. 2-1 - 2-9; In English; See also 20000089819; Copyright Waived; Avail: CASI; A02, Hardcopy

This paper discusses the Auditory Risk Criteria as currently being proposed in a draft ANSI Standard The criteria include two general prediction methods for estimating the hazard. One method, called the survey method, uses the A-weighted energy under a hearing protector to estimate the amount of hearing loss likely to be found for an exposed population. The second method, called a computer modeling method, provides an assessment for each individual waveform of an exposed population The standard will provide the necessary software for this model. The standard will not provide specific criteria while wearing hearing protection, but instead will provide suggested validation procedures to insure that a specific program in which hearing protection is used actually is preventing hearing loss, either temporary or permanent. Criteria for identifying acoustic trauma and excessive fetal impulse noise will also be included.
Author
Computerized Simulation; Impulses; Prediction Analysis Techniques; Protection; Noise (Sound); Standards

20000089822 Institut Franco-Allemand de Recherches, Saint-Louis, France
PERFORMANCE OF HEARING PROTECTORS IN IMPULSE NOISE
Buck, K., Institut Franco-Allemand de Recherches, France; Damage Risk from Impulse Noise; September 2000, pp. 3-1 - 3-10; In English; See also 20000089819; Copyright Waived; Avail: CASI; A02, Hardcopy

The present paper describes the problems that may occur when hearing protectors, usually designed for industrial noise environments, are used in military impulse noise. The military impulse noise environment is described as well as the different types of passive and active hearing protectors and the used measurement procedures. The different mechanisms that may alter the effectiveness of different types of hearing protectors, as well as the global efficiency when submitted to high level impulse noise, will be shown.
Author
Hearing; Protectors; Noise (Sound)

20000089823 Air Force Research Lab., Wright-Patterson AFB, OH USA
COMMUNICATION AND LOCALIZATION WITH HEARING PROTECTORS
McKinley, Richard L., Air Force Research Lab., USA; Damage Risk from Impulse Noise; September 2000, pp. 4-1 - 4-14; In English; See also 20000089819; Copyright Waived; Avail: CASI; A03, Hardcopy

Hearing protectors are frequently used to preserve hearing when personnel are working in areas of high pulse and/or continuous noise. Speech communication and auditory localization are two important functions of the auditory system, which potentially are impeded when circumaural and/or insert hearing protectors are used. This paper describes the measured effects of hearing protectors on speech communication and auditory localization. The effects on auditory localization include interactions with the visual system and the resulting effects on locating potential objects which may pose a threat to the listener. Implications for military and civilian users of hearing protectors are discussed.
Author
Hearing; Protectors; Communication; Speech Recognition

20000089824 Institut Franco-Allemand de Recherches, Saint-Louis, France
INDIVIDUAL SUSCEPTIBILITY TO NIHL AND NEW PERSPECTIVE IN TREATMENT OF ACUTE NOISE TRAUMA
Dancer, A. L., Institut Franco-Allemand de Recherches, France; Damage Risk from Impulse Noise; September 2000, pp. 5-5 - 5-12; In English; See also 20000089819; Copyright Waived; Avail: CASI; A03, Hardcopy

There would be great interest in finding a test which predicts individual susceptibility to permanent threshold shift. Such test would allow identification of people who are most likely to suffer hearing damage in high noise areas and thereby reduce the number of people presenting NIHL. Considering the consequences of NIHL for the health of the soldiers, the cost of the treatments, the operational and compensation costs induced by NIHL, it is necessary to assess the actual efficiency of the present medical treatments of the acoustic trauma. Preliminary results indicate that some treatments speed up the recovery and correspond to lower threshold shifts and smaller morphological damages. Moreover, experiments are in progress to assess the interest of new treatments applied directly to the inner ear.
Author
Damage; Ear; Hearing; Performance Tests

20000089825 Army Center for Health Promotion and Preventive Medicine (Provisional), Aberdeen Proving Ground, MD USA
COST EFFECTIVENESS OF HEARING CONSERVATION PROGRAMS
Ohlin, Doug, Army Center for Health Promotion and Preventive Medicine (Provisional), USA; Damage Risk from Impulse Noise; September 2000, pp. 6-1 - 6-5; In English; See also 20000089819; Copyright Waived; Avail: CASI; A01, Hardcopy

In 1999, The Department of Veterans Affairs (VA) reported $291,622,148 for 56,792 veterans receiving hearing loss as a major disability. Civilian hearing loss compensation in that year was $35,346,392 for 6,406 Federal employees. The medical community has often qualified such data, noting that these monetary outlays do not reflect the more important factors of decreased job performance and loss in the quality of life. The reality of decreasing workforces and decreasing budgets have forced us, though, to market hearing conservation programs on the basis of economic benefits. Medical outcomes, spanning 20-years of rigorous program implementation, have been translated into over $500 million of projected training cost savings. Comparisons among the services have also been used to demonstrate cost avoidance for civilian hearing loss and VA disability. Explanations for differences among the services are presented. For example, the National Institute for Occupational Safety and Health (NIOSH) has made what they are calling a paradigm shift in their program focus from the agent (noise hazard) to preventing hearing loss. The Army Occupational Health and Industrial Hygiene leadership made this shift over 29 years ago.
Author
Cost Effectiveness; Hazards; Hearing; Human Performance; Industrial Safety; Losses; Noise (Sound); Safety

20000089826 Brueel, Bertrand and Johnson Acoustics, Provo, UT USA
NON-AUDITORY DAMAGE RISK ASSESSMENT FOR IMPULSE NOISE
Johnson, Daniel L., Brueel, Bertrand and Johnson Acoustics, USA; Damage Risk from Impulse Noise; September 2000, pp. 7-1 - 7-8; In English; See also 20000089819; Copyright Waived; Avail: CASI; A02, Hardcopy

This paper discusses the non-injury thresholds established for three different complex waveforms. These animal studies were

accomplished by EG&G at the Blast overpressure Test Site at Kirtland AFB in New Mexico. Human volunteer studies were also performed. The human studies verified non-injury levels for three different freefield waveforms and one complex waveform. The use of the Bowen model developed nearly 40 years earlier, as well as two later models, will be discussed. A simple relationship between an 'acceptability limit' and the non-auditory injury limit was found to exist. This 'acceptability limit' was found to be approximately 70 % to 80% of the non-injury limit in peak pressure in kPa. This small reduction in peak level provides a sufficient safety factor for all possible waveforms, both complex and freefield, and a simple mathematical equation is recommended as a practical design goal. Author

Safety Factors; Injuries; Damage Assessment; Noise (Sound)

20010033284 Air Force Academy, CO USA

DEVELOPMENT OF VIRTUAL AUDITORY INTERFACES

Shilling, Russell D., Air Force Academy, USA; Letowski, Tomasz, Army Research Lab., USA; What is Essential for Virtual Reality Systems to Meet Military Human Performance Goals?; March 2001, pp. 18-1 - 18-3; In English; See also 20010033269; Copyright Waived; Avail: CASI; A01, Hardcopy; A02, Microfiche

The design of visual components in virtual environments has shown rapid improvement and innovation. However, the design of auditory interfaces has lagged behind. Whereas visual scenes have become more compelling. the auditory portions of VE remain rudimentary. This disparity is perplexing since auditory cues play a crucial role in our day-to-day lives. Imagine entering a meeting with a room full of people. When you enter the room you realize that the speaker's voice is emanating from all points in the room. yet the room is totally anechoic. In addition. you see other attendees moving in the room. there are no additional noises in the room except the speaker's voice. Despite walking into a 'real' environment, your sense of reality would most probably be challenged. In fact, it is generally believed that the sense of presence is dependent upon auditory, visual, and tactile fidelity (Sheriden, 1996). Although the sense of realism in VIE is also dependent on visual fidelity, virtual or spatial sound has been shown to increase the sense of -presence' (Hendrix, 1996). It stands to reason that when we develop poor auditory interfaces in a VE the perceived quality of the entire VE is compromised (Storms, 1998). The problem with audio is that our normal auditory environment is 'transparent'. We don't consciously process a sound in our environment unless we NEED to attend to it. Yet, when slogging through mud while on patrol, soldiers use auditory cues to keep track of the people around them while scanning for threats in front of them. They don't need to keep looking at the people around them. While not consciously processing the sounds of their comrades, if someone stops walking, they'll recognize the lack of sound instantly.

Derived from text

Virtual Reality; Auditory Tasks; Systems Engineering; Acoustic Properties; Interfaces; Acoustics

20010067692 Societe Nationale d'Etude et de Construction de Moteurs d'Aviation, Dept. Acoustique, Moissy-Cramayel, France

ACTIVE CONTROL OF THE DIRECTIVITY OF FAN TONES NOISE

Julliard, J., Societe Nationale d'Etude et de Construction de Moteurs d'Aviation, France; Antoine, H., Societe Nationale d'Etude et de Construction de Moteurs d'Aviation, France; Lozachmeur, C., Societe Nationale d'Etude et de Construction de Moteurs d'Aviation, France; Roure, A., Centre National de la Recherche Scientifique, France; Active Control Technology for Enhanced Performance Operational Capabilities of Military Aircraft, Land Vehicles and Sea Vehicles; June 2001, pp. 18-1 - 18-10; In English; See also 20010067671; Copyright Waived; Avail: CASI; A02, Hardcopy

Experiments on a fan model (diameter 47 cm, 48 blades, nominal rotation speed 12,600 rpm) installed in an anechoic test cell have recently been carried out to assess the technique of Active Noise Control (ANC) applied to reduce the tones noise at the blade passage frequency. This paper describes in details the test model with the selected test configurations, the test facility, and the ANC system.

Author

Acoustic Properties; Active Control; Aerodynamic Noise; Noise Reduction

20010067695 Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Inst. fuer Antriebstechnik, Berlin, Germany

A MODAL CONCEPT FOR ACTIVE NOISE CONTROL IN CIRCULAR OR ANNULAR DUCTS

Tapken, Ulf, Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; Zhang, Yan-Chang, Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; Enghardt, Lars, Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; Neise, Wolfgang, Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; Active Control Technology for Enhanced Performance Operational Capabilities of Military Aircraft, Land Vehicles and Sea Vehicles; June 2001, pp. 19-1 - 19-7; In English; See also 20010067671; Original contains color illustrations; Copyright Waived; Avail: CASI; A02, Hardcopy

Active control of sound propagation in ducts plays an important role in many technical applications, e.g., the attenuation of noise in ventilating systems or in the exhaust systems of combustion engines. Today many control strategies exist for the simplest case, which is the noise control in the low frequency range in ducts the lateral dimensions of which are small compared to the wavelength of sound. Up to the cut-on frequency of the first higher order mode a suppression of the propagating plane sound waves is possible in a broad frequency range. The situation is more difficult when the lateral duct dimensions become large compared to the wavelength, as for example in the intake section of an aircraft engine. With increasing rotor speed an increasing number of acoustical modes becomes present. This means the system comprises an increasing number of degrees of freedom. As a consequence, control of the sound field is practicable just in a narrow frequency band or even limited to discrete frequencies.

Derived from text

Active Control; Annular Ducts; Sound Propagation; Computerized Simulation

20010067702 Deutsches Zentrum fuer Luft- und Raumfahrt e.V., Brunswick, Germany

HELICOPTER NOISE REDUCTION BY INDIVIDUAL BLADE CONTROL (IBC): SELECTED FLIGHT TEST AND SIMULATION RESULTS

Splettstoesser, W. R., Deutsches Zentrum fuer Luft- und Raumfahrt e.V., Germany; Schultz, K.-J., Deutsches Zentrum fuer Luft- und Raumfahrt e.V., Germany; vanderWall, B., Deutsches Zentrum fuer Luft- und Raumfahrt e.V., Germany; Buchholz, H., Deutsches Zentrum fuer Luft- und Raumfahrt e.V., Germany; Gembler, W., Eurocopter Deutschland G.m.b.H., Germany; Niesl, G., Eurocopter Deutschland G.m.b.H., Germany; Active Control Technology for Enhanced Performance Operational Capabilities of Military Aircraft, Land Vehicles and Sea Vehicles; June 2001, pp. 30-1 - 30-16; In English; See also 20010067671; Copyright Waived; Avail: CASI; A03, Hardcopy

A collaborative flight test program was conducted to study among other objectives the potential of open-loop Individual Blade Pitch Control (IBC) to reduce the external noise of a helicopter in partial power descent, flight regime known to generate the highly annoying Blade-Vortex Interaction (BVI) impulsive noise. The blade root control system employing actuators in the rotating frame was installed on a BO 105 helicopter, which was flown over an extended linear microphone array. The acoustic measurements on the ground were synchronized to the flight track and rotor performance measurements supplemented by limited simultaneously acquired onboard acoustic and blade surface pressure data. Selected test results quantifying the noise reduction potential of the IBC technique, are presented and compared to numerical rotor simulation results calculated by the aeromechanic S4 code and the acoustic AKUROT code of the DLR. A significant noise reduction benefit (exceeding 5 dB) of the maximum A-weighted (BVI) noise level was obtained for the 2/rev IBC mode; further, over a wide range of ERC phase angles simultaneous noise and vibration reductions were observed. The complete data base acquired will contribute to the development and validation of a fast control algorithm for closed-loop ERC applications.

Author

Noise Measurement; Aircraft Noise; Blade-Vortex Interaction; Noise Reduction

20010067706 Otto-von-Guericke Univ., Dept. of Adaptronics, Magdeburg, Germany
ACTIVE STRUCTURAL ACOUSTIC CONTROL AS AN APPROACH TO ACOUSTIC OPTIMIZATION OF LIGHTWEIGHT STRUCTURES
Mayer, Dirk, Otto-von-Guericke Univ., Germany; Vogl, Bernd, Otto-von-Guericke Univ., Germany; Hanselka, Holger, Otto-von-Guericke Univ., Germany; Active Control Technology for Enhanced Performance Operational Capabilities of Military Aircraft, Land Vehicles and Sea Vehicles; June 2001, pp. 2-1 - 2-8; In English; See also 20010067671; Original contains color illustrations; Copyright Waived; Avail: CASI; A02, Hardcopy

Conventional approaches to optimizing the acoustic behavior of lightweight structures have mainly been restricted to the concept of Active Noise Control (AMC). This concept is aimed to attenuating primary noise sources with secondary controlled noise sources by taking advantage of destructive interference. However, it is also possible to actively control the vibrating structure using piezoceramic actuators to alter very intensively sound-radiating operating deflection shapes. This approach is referred to as Active Structural Acoustic Control (ASAC). The applicability of this concept to real systems is demonstrated by means of a simple model with experimental measurement systems employed in the lower frequency range. This study focuses on the utilization of a modern measurement technology, i.e., the Spatial Transformation of Sound Fields (STSF), which facilitates the determination of important parameters of the vibro-acoustic system at a time. The radiation efficiency is of major importance to the evaluation of the acoustic system behavior. As the lower frequency range is considered, the dynamic system behavior is determined by means of the Experimental Modal Analysis (EMA). The results of this study show the radiation efficiency of the unregulated and of the actively controlled system.
Author
Active Control; Acoustic Properties; Optimization; Noise Reduction

72
ATOMIC AND MOLECULAR PHYSICS

20000047280 Defence Evaluation Research Agency, Radiation Protection Services, Gosport, UK
RADIOACTIVE WASTES IN A CONVENTIONAL MILITARY ENVIRONMENT
Clark, S. M., Defence Evaluation Research Agency, UK; Approaches to the Implementation of Environment Pollution Prevention Technologies at Military Bases; April 2000, pp. 18-1 - 18-4; In English; See also 20000047263; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

Although other types of radioactive waste exist, it is intended to concentrate on wastes originating from the process of luminising military equipment as this constitutes the bulk of the waste. The talk outlines the way radioactive materials have been used for the purpose of luminising UK military equipment, from its first use during the First World War, through its expansion of use in the Second World War to the current situation. The way in which the radioactive materials have been used, and the type of radioactive material used, is explored as are the consequences of the luminising of military equipment.
Derived from text
Radioactive Materials; Radioactive Wastes; Waste Disposal; United Kingdom

74
OPTICS

20000011774 Army Aeromedical Research Lab., Aircrew Health and Performance Div., Fort Rucker, AL USA
EXTERNAL POSITION LIGHTING EFFECTS ON NIGHT VISION GOGGLE PERFORMANCE
Wildzunas, Robert M., Army Aeromedical Research Lab., USA; McLean, William E., Army Aeromedical Research Lab., USA; Rash, Clarence E., Army Aeromedical Research Lab., USA; Current Aeromedical Issues in Rotary Wing Operations; August 1999, pp. 43-1 - 43-8; In English; See also 20000011735; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

Army aviation depends heavily on image intensification devices to extend operations into the night. Such devices are light amplification systems that adjust their amplification factor (gain) according to the level of ambient illumination. However, these night vision goggles (NVGs) are unable to distinguish between light originating from the exterior scene and light originating from either instruments inside the cockpit or lights mounted to the aircraft. Consequently, the NVG may lower gain unnecessarily, and in doing so, degrade image quality. The compatibility problem is most apparent when light in the red part of the spectrum is present. This is the problem with the UH-1's red lateral position lights. These lights flood into the cockpit, affecting NVG performance - the presence of fog and other weather heightens this effect. A solution to this problem has been to mask appropriate upper and lower portions of the two red position lights, thereby reducing the NVG degradation. However, this solution appeared to conflict with Federal Aviation Regulation (FAR) lighting intensity distributions for each of the two lights. We calculated that the FAR could be satisfied at a distance of one rotor disk radius by masking 82 degrees of each respective position light (leaving 98 degrees unmasked). Objective video recordings and test pilots' subjective observations indicate a significant reduction in NVG degradation with the 82-degree masking scheme as compared to operations with unmasked position lights. The 82-degree masking scheme meets the FAR requirements while reducing simultaneously the performance degradation of the NVG devices. We will show a composite video with observations at the meeting.
Author
Night Vision; Goggles; Image Intensifiers; Test Pilots; Cockpits; Uh-1 Helicopter; Luminous Intensity; Amplification

20010012837 Ballistic Missile Defense Organization, Washington, DC USA
QUANTUM WELL INFRARED FOCAL PLANE ARRAYS FOR BALLISTIC MISSILE DEFENSE AND SPACE APPLICATIONS
Tidrow, M. Z., Ballistic Missile Defense Organization, USA; Dyer, W. R., Ballistic Missile Defense Organization, USA; Space-Based Observation Technology; October 2000, pp. 29-1 - 29-6; In English; See also 20010012824; Copyright Waived; Avail: CASI; A02, Hardcopy

Quantum Well Infrared (IR) Photodetectors (QWIP) have been developed very quickly and demonstrated large format focal plane arrays with low noise equivalent irradiance, high uniformity, and high operability. Using the high quality GaAs material systems, QWIPs have the potential for high production yield, low cost and low power consumption. Infrared focal plane arrays (FPAs) are widely used in ballistic missile defense (BMD) for surveillance, target detection, target tracking, and discrimination. These functions are performed from satellites, aircraft platforms, fixed locations or interceptors. Some ballistic missile defense sensor functions can be performed with single-color FPAs, while others require simultaneous measurements in two to four IR bands. The temperatures of most advanced BMD targets require FPA wavelengths in the mid-wave IR (MWIR), long-wave IR (LWIR), or very-long-wave IR (VLWIR) bands. Important FPA characteristics for future BMD FPAs will include large format, high sensitivity, low 1/f noise, good uniformity, and high operability. Due to the colder environment in space applications, VLWIR is very important for sensor design, QWIPs have lower sensitivity than mercury cadmium telluride FPAs at MWIR and LWIR wavelengths, but QWIP's performance at low temperature and very-long-IR makes it especially attractive for IR space systems. In addition, multicolor VLWIR sensing is important to eliminate the effects of earthshine in exoatmospheric discrimination. Superior multicolor capability has been demonstrated in QWIP manufacture. In this paper, an overview of the state-of-the-art of IR sensors will be given, and the advantages and shortfalls of QWIPs for BMD and space-based applications will be discussed.
Author
Quantum Wells; Quantum Well Lasers; Focal Plane Devices; Arrays; Infrared Detectors; Photometers

20010012840 Astrium Ltd., Directorate of Science and Earth Observation and Meteorology, Portsmouth, UK
ENVISAT ASAR - DESIGN & PERFORMANCE WITH A VIEW TO THE FUTURE
Hutchinson, Michael, Astrium Ltd., UK; Gibbons, Michael D., Astrium Ltd., UK; Space-Based Observation Technology; October 2000, pp. 34-1 - 34-8; In English; See also 20010012824; Sponsord in part by

Astrium GMBH; Copyright Waived; Avail: CASI; A02, Hardcopy

The Advanced Synthetic Aperture Radar (ASAR) is a 'C' band dual linear polarized multi-mode terrain monitoring radar forming part of the environmental satellite (ENVISAT) mission. It is to be launched on Ariane 5 in 2001. With heritage from the highly successful ERS-1 & ERS-2 SAR instruments Astrium Ltd. have developed the system design of ASAR in order to provide polarisation diversity, flexible swath selection, and wide swath techniques providing a range of operating modes with data products to suit various needs. This paper describes the overall instrument architecture summarizing the key technology areas and the characteristics of each operating mode. It also reviews the major technical challenges that were faced and how they were resolved. The ASAR design based on the use of an active antenna, with individual subarray temperature compensation and internal calibration loop, is complex but a breakthrough with respect to earlier passive antenna designs. The instrument calibration scheme is described and the predicted system performance presented for key parameters based on FM test results. Budgets for mass and power are also provided. The paper concludes with a review of the future SAR development activities that are currently in progress at Astrium Ltd (formerly Matra Marconi Space (UK)).
Derived from text

Synthetic Aperture Radar; Envisat-1 Satellite; Satellite Design; Ers-2 (Esa Satellite); Ers-1 (Esa Satellite)

75
PLASMA PHYSICS

20000039704 Academy of Sciences (USSR), Inst. for Problems in Mechanics, Moscow, USSR

OVERVIEW OF CHARACTERISTICS AND EXPERIMENTS IN IPM PLASMATRONS

Gordeev, A. N., Academy of Sciences (USSR), USSR; Measurement Techniques for High Enthalpy and Plasma Flows; April 2000, pp. 1A-1 - 1A-18; In English; See also 20000039703; Copyright Waived; Avail: CASI; A03, Hardcopy

Characteristics of IPG series plasmatrons as well as there application for reentry simulation and testing of thermal protection materials are discussed in the presented paper on the basis of 35 years experience of Plasma Laboratory of IPM RAS. Successful application of plasmatrons for simulation of reentry conditions and testing of thermal protection materials is based on using of plasmatron's advantages such as purity of plasma flow, its high stability, excellent reproducibility as well as wide ranges of realized pressure and heat flux. Using of subsonic regimes together with plasmatron's ability for independent smooth regulation of regime parameters such as pressure and power injected in plasma make a plasmatron the most flexible and powerful instrument for simulation of thermochemical action of shock layer on the surface of descent space vehicle, especially when it is necessary to solve problems concerned radiative & convective heating and/or non-equilibrium heat transfer. To the present day long-term aging tests (up to 100 15-minute testing cycles for one sample) in dissociated gas flow were fulfilled only using plasmatrons. Also there are discussed tests of ablative thermal protection materials, studies of thermo-chemical interaction between dissociated flows and reusable thermal protection materials as well as some 'non-space' applications of plasmatron's as deposition of diamond films and testing of industrial materials on heat shock.
Author

Performance Prediction; Plasmatrons; Experimentation; Thermal Protection; Reentry Shielding; Stability; Convective Heat Transfer; Ablative Materials

20000039713 Academy of Sciences (USSR), Inst. for Problems in Mechanics, Moscow, USSR

COMBINED MEASUREMENTS AND COMPUTATIONS OF HIGH ENTHALPY AND PLASMA FLOWS FOR DETERMINATION OF TPM SURFACE CATALYCITY

Kolesnikov, A. F., Academy of Sciences (USSR), USSR; Measurement Techniques for High Enthalpy and Plasma Flows; April 2000, pp. 8A-1 - 8A-16; In English; See also 20000039703; Sponsored in part by RTA
Contract(s)/Grant(s): RTA-4329A; ISTC Proj. 036; Copyright Waived; Avail: CASI; A03, Hardcopy

The paper presents the method for the TPM catalycity prediction on the basis of high enthalpy plasmatron heat transfer tests, performed in subsonic regimes, and appropriate CFD modeling of the whole plasma flow field in the plasma wind tunnel (I), viscous reacting gas flows around a test model (2) a nonequilibrium boundary layer near the stagnation point of a test model (3) and analysis of the the heat transfer for test conditions at the small Reynolds and Mach numbers (4). In general, the methodology was developed during the study of the catalytic efficiencies of the Buran TPM - the black ceramic tile and the C-C material with antioxidation coating - in dissociated nitrogen and air reacting flows. This experimental-theoretical methodology has been modified recently for the determination of TPM catalycity in subsonic carbon dioxide and pure oxygen flows from high enthalpy tests performed by using the 100-kW inductive IPG-4 plasmatron. The interaction between combined ground test measurements and CFD modeling is considered as genesis for catalytic effects duplication, plasma flow field rebuilding and the extraction of the quantitative catalycity parameters from the measured high enthalpy flow parameters, surface temperature and stagnation point heat fluxes.
Author

Computational Fluid Dynamics; Enthalpy; Plasma Flux Measurement; Procedures; Heat Transfer; Surface Temperature; Flow Characteristics; Magnetohydrodynamic Flow

20000039719 Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese, Belgium

THE VKI PLASMATRON CHARACTERISTICS AND PERFORMANCE

Bottin, B., Von Karman Inst. for Fluid Dynamics, Belgium; Chazot, O., Von Karman Inst. for Fluid Dynamics, Belgium; Carbonaro, M., Von Karman Inst. for Fluid Dynamics, Belgium; VanDerHaegen, V., Von Karman Inst. for Fluid Dynamics, Belgium; Paris, S., Von Karman Inst. for Fluid Dynamics, Belgium; Measurement Techniques for High Enthalpy and Plasma Flows; April 2000, pp. 6-1 - 6-26; In English; See also 20000039703; Copyright Waived; Avail: CASI; A03, Hardcopy

The von Karman Institute (VKI) recently completed the commissioning of a new inductively-coupled plasma wind tunnel ('Plasmatron') devoted to the simulation of thermal re-entry conditions as applicable to TPS materials used on real flight trajectories. In the context of the commissioning, two main intrusive measurement techniques, the Pitot tube and the calorimetric heat flux probe, were developed and extensively used to record the performance in order to compare them with the specifications. During the commissioning phase, other techniques were being developed in another VKI facility, the Minitorch, a small inductively-coupled plasma torch used as the instrumental test bench for the Plasmatron. This paper presents the Plasmatron facility to the reader, then describes in detail the probes that were used, the test methodology that was followed, and the results that were obtained during the commissioning phase. The technique of laser Doppler velocimetry (LDV), which is currently developed in the Minitorch and envisaged as one of the standard Plasmatron techniques in the near future, is also described in detail.
Author

Plasmatrons; Performance Tests; Simulation; Reentry; Heat Flux

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PHYSICS OF ELEMENTARY PARTICLES AND FIELDS

20000020871 Alfa Romeo S.p.A., Research and Development Dept., Naples, Italy

NUMERICAL PREDICTIONS AND EXPERIMENTAL MEASUREMENTS OF RADIATIVE HEAT TRANSFER IN GAS TURBINE COMBUSTORS

DiMartino, P., Alfa Romeo S.p.A., Italy; Cinque, G., Alfa Romeo S.p.A., Italy; Gas Turbine Engine Combustion, Emissions and Alternative Fuels; June 1999, pp. 49-1 - 49-13; In English; See also 20000020829; Copyright Waived; Avail: CASI; A03, Hardcopy; A06, Microfiche

The present paper is concerned with the calculation of the flowfield heat transfer and turbulent combustion processes inside a single annular reverse-flow gas turbine combustor for aircraft engines. Numerical analysis has been carried out by using a CFD home computer code based on finite-volume method and body-

conforming non-orthogonal structured grids. Emphasis has been put on the evaluation of wall temperatures distribution, which was assumed in previous works. A comparison with experimental measurements obtained by means of thermal paints has also been performed. A method to evaluate wall temperatures and radiative heat fluxes is described. No attempt has been made to account for the presence of soot First results obtained seem encouraging in that the trend of calculations is in good agreement with experiments. While an amount of work remains to be done in improving physical models, this study shows that CFD can be used as a tool in studying the main features of a gas turbine combustor and in correlation important design parameters.
Author
Radiative Heat Transfer; Gas Turbine Engines; Flow Distribution; Finite Volume Method; Turbulent Combustion; Combustion Chambers; Wall Temperature

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ADMINISTRATION AND MANAGEMENT

19990092807 Defence Research Establishment Valcartier, Decision Support Technological Section, Val Belair, Quebec Canada
ON THE DESIGN OF A DECISION SUPPORT SYSTEM FOR DATA FUSION AND RESOURCE MANAGEMENT IN A MODERN FRIGATE
Chalmers, Bruce A., Defence Research Establishment Valcartier, Canada; Sensor Data Fusion and Integration of the Human Element; February 1999, pp. 2-1 - 2-13; In English; See also 19990092805; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

Decision support has been identified as a focus of attention for the mid-life upgrade of the command and control system (CCS) of the HALIFAX class frigate, anticipated in the 2005-2010 timeframe. To support this effort we are exploring concepts for the design of computer-based decision aids that can be integrated into the CCS to assist operators in their tactical Command and Control (C2) activities. To date, the emphasis has been on investigating algorithms for aiding operators with their decision making tasks, including picture compilation, situation and threat assessment, and resource management. To support this effort and develop an integrated set of aids, a systematic framework is now needed to identify the requirements that an effective computer-based decision support system (DSS) should satisfy. Determining support interventions in the work environment of tactical C2 is a challenging problem due to a number of its characteristics (e.g., time critical decision making under uncertainty, high risk, dynamism, social cooperation, large amounts of data, unanticipated variabilities that are similar to those observed in other complex sociotechnical systems in the civilian world, while introducing new ones. (e.g., organized, intelligent threats to the mission, limited advance knowledge of threats.) Whatever the chosen analysis and design framework it should be tailored to the unique demands imposed by these factors. This pa;per reviews a range of concepts being explored for the design of the DSS, focusing on automation, cognitive and methodological issues. It is a constraint based approach to modeling a complex sociotechnical work system that provides an overarching framework and a variety of flexible conceptual tools for systematically investigating the space of design interventions in the joint human-machine system. The paper also identifies a high-level framework for the immediate design goal, a DSS that can support operators, with data fusion, situation and threat assessment and resource management.
Author
Computer Techniques; Decision Support Systems; Man Machine Systems; Multisensor Fusion; Resources Management; Decision Making; Command And Control

20000047278 Defence Materiel Administration, Stockholm, Sweden
R3 - MANAGEMENT IN DEMIL OPERATIONS: TODAY AND TOMORROW
Hoernstroem, Hanna, Defence Materiel Administration, Sweden; Stroemsteadt, Bengt, Defence Materiel Administration, Sweden; Approaches to the Implementation of Environment Pollution Prevention Technologies at Military Bases; April 2000, pp. 16-1 - 16-10; In English; See also 20000047263; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

After World War II surplus munition in Sweden was dumped in lakes, mines and in the open sea. During the late 60's environmental concerns led to a ban on dumping. OB/OD therefore became the main method for demil of munitions. Growing environmental concern in the 70's resulted in a small scale start of industrialized demil which during the 80's steadily increased. During the 90's demil of munition has been characterized by focus on recovery, reuse and recycling. This is due to a more rigorous environmental legislation coupled with an awakening environmental awareness in the Armed Forces and the discovery that an environmentally adapted demil process can be economically beneficial compared to OB/OD. A high degree of resource recovery and reuse (R3) is now obtained in the demil process, but some problems remain e.g. smoke and illuminating ammunition. Some approaches to handle these challenges are discussed. The problem with the old dumpsites are also discussed: a survey has been performed in order to locate the numerous sites and measures are taken to investigate the risk for ecological effects. The dumped ammunition also constitutes a potential safety problem at some of the locations, both with regard to unintentional handling by the public and by potential detonation of unstable munition. (Some results from examination of dumped ammunition are presented). The high focus on R3 in demil operations in Sweden is in line with the political ambition for Sweden to be among the leading nations in the efforts to obtain a sustainable development of society. The Armed Forces and the Defence Materiel Administration are among the governmental authorities actively working to contribute to this strive. The work to implement an environmental management system according to ISO 14001 in the defence sector has started. The government has issued a command to the two authorities to jointly adapt guidelines for environmentally sound provision of defence materiel. The main environmental objective concerning demil in Sweden at present is to totally eliminate the need for OB/OD to dispose of surplus munitions. This method must in the near future be replaced by even more optimal industrial processes focusing on recovering materials, explosives as well as metals, even in those ammunition components where we today still have some problems. State-of-the-art technology is a prerequisite to achieve fully environmentally adapted demil operations, as well as an innovative and life-cycle-oriented way of managing environmental aspects in all processes. International co-operation is of course a valuable tool for sharing knowledge and experience, which is necessary for achieving the best possible demil methods.
Author
Environment Management; Environment Protection; Explosives; Disposal; Recycling; Reuse

20000119920 Royal Air Force, Logistic Support Costing, Huntingdon, UK
MINIMIZING LOGISTIC SUPPORT COSTS MODELLING TECHNIQUES IN THE ROYAL AIR FORCE
Boydell, F., Royal Air Force, UK; Design for Low Cost Operation and Support; September 2000, pp. 2-1 - 2-5; In English; See also 20000119918; Copyright Waived; Avail: CASI; A01, Hardcopy

In all MOD procurement programs, LCC (life cycle cost) is a prime metric in the selection process. The single biggest portion of a weapons system's LCC is the Logistic Support Cost (LSC). This paper will address the major considerations, models and analytical methods currently employed by the RAF to achieve maximum aircraft operational capability for the minimum LSC and analytical effort. The paper is broken into 2 distinct areas: introduction to service and through life support.
Derived from text
Logistics Management; Cost Analysis; Design To Cost; Costs; Life Cycle Costs

20010003246 Department of the Air Force, 56th Operations Group, Luke AFB, AZ USA
WINNING IN TIME: ENABLING NATURALISTIC DECISION MAKING IN COMMAND AND CONTROL
Louisell, William C., Department of the Air Force, USA; Usability of Information in Battle Management Operations; November 2000, pp. 1-1 - 1-8; In English; See also 20010003245; Copyright Waived; Avail: CASI; A02, Hardcopy

Key US proponents of the Revolution in Military Affairs described future war as a system of systems in which dominant battlespace knowledge would enable a system of sensors and shooters to be connected for the purpose of engagement through an

advanced, information technology-based command and control function. Through dominant battlespace knowledge, the command and control function would achieve efficiency levels which would greatly alter the nature of conflict current time constants in the decision, action, feedback loop would be drastically shortened. The nature of weapons and platforms would change and the organization and training of forces would change.
Author
Command And Control; Information Systems; Warfare; Planning; Military Technology

20010003250 Stress Research Center, High Military Coll. of Ground Forces, Prague, Czechoslovakia
COMMAND DECISION-MAKING AIDED BY DYNAMIC SOCIOGRAPHY
Sykora, Jaroslav, Stress Research Center, Czechoslovakia; Dworak, Joseph, Stress Research Center, Czechoslovakia; Michalek, Pavel, Stress Research Center, Czechoslovakia; Novotny, David, Stress Research Center, Czechoslovakia; Usability of Information in Battle Management Operations; November 2000, pp. 6-1 - 6-3; In English; See also 20010003245; Copyright Waived; Avail: CASI; A01, Hardcopy

Command and control operations became increasingly more complex if not chaotic under real battle conditions. At the same time the importance of psychosocial factors in battle management operations increases. Thus the uncertainty of decision making is enhanced. The aim of our research is to augment the cognitive utility in command and control management processes, using new information technologies of dynamic sociometry for the analysis of systems, based on uncertain, ambiguous, and poorly defined elements.
Author
Decision Making; Command And Control; Warfare; Evaluation; Management Analysis

20010019318 Defence Evaluation Research Agency, Fareham, UK
WRAPPING THE COTS DILEMMA
White, Ian, Defence Evaluation Research Agency, UK; Commercial Off-the-Shelf Products in Defence Applications 'The Ruthless Pursuit of COTS'; December 2000, pp. 1-1 - 1-11; In English; See also 20010019317
Report No.(s): ISBN 92-837-1049-5; Copyright Waived; Avail: CASI; A03, Hardcopy

This paper first reviews the problems of using Commercial Off-the-Shelf Products (COTS), notably product assurance, vulnerability, and product continuity. The concept of wrapping is then introduced. Conceptually, wrapping is a process to mitigate COTS limitations, and may be applied to any of the acquisition, design, and implementation phases of a system. It is a fundamental assumption that COTS items being wrapped are not themselves amenable to any significant changes in their design or function.
Author
Quality Control; Commercialization; Information Systems; Vulnerability; Computer Programs

20010019319 University Coll., Defence Engineering Group, London, UK
THE COTS IT CIRCLE
Weiss, Alex, University Coll., UK; Commercial Off-the-Shelf Products in Defence Applications 'The Ruthless Pursuit of COTS'; December 2000, pp. 2-1 - 2-8; In English; See also 20010019317
Report No.(s): ISBN 92-837-1049-5; Copyright Waived; Avail: CASI; A02, Hardcopy

An examination of the issues raised by using Commercial Off-the-Shelf (COTS) Information Technology (IT) in operational military equipment, the decisions that need to be made, and who has to make them are discussed. It starts by examining the main operational issues.
Author
Information Systems; Computer Programs; Commercialization; Decision Making; Operations Research

20010019322 Army Communications-Electronics Command, Command and Control Research, Development and Engineering Center, Fort Monmouth, NJ USA
USA ARMY COMMERCIAL OFF-THE-SHELF (COTS) EXPERIENCE: THE PROMISES AND REALITIES
Barbarello, James J., Army Communications-Electronics Command, USA; Kasian, Walter, Army Communications-Electronics Command, USA; Commercial Off-the-Shelf Products in Defence Applications 'The Ruthless Pursuit of COTS'; December 2000, pp. 5-1 - 5-9; In English; See also 20010019317
Report No.(s): ISBN 92-837-1049-5; Copyright Waived; Avail: CASI; A02, Hardcopy

The US Army Communications-Electronics Command, commonly called CECOM, has been aggressively pursuing Commercial-Off-the-Shelf (COTS) materiel solutions for well over a decade. With that experience, CECOM has developed a strategy of 'Adopt, Adapt, Develop'. Through a series of case studies, this paper will explain when CECOM adopts COTS directly, adapts COTS products (by modifying as necessary to meet operational needs), and develops solutions when no COTS products will meet the Army's needs.
Author
Commercialization; Product Development; Improvement; Utilization

20010019323 North Atlantic Treaty Organization, The Hague, Netherlands
THE COORDINATED DEFENCE ROLE IN CIVIL (TELECOM) STANDARDISATION
Thorlby, J. P., North Atlantic Treaty Organization, Netherlands; Commercial Off-the-Shelf Products in Defence Applications 'The Ruthless Pursuit of COTS'; December 2000, pp. 6-1 - 6-8; In English; See also 20010019317
Report No.(s): ISBN 92-837-1049-5; Copyright Waived; Avail: CASI; A02, Hardcopy

The 'ruthless pursuit of Commercial Off-the-Shelf (COTS) products' is increasing the penetration of unmodified COTS technology and standards in the military domain. Therefore, as the defense community becomes more reliant on off the shelf products and standards, it is increasingly a stake-holder in the results of the civil process. This should lead to a motivation to be a proactive participant in the civil process by which the civil standards (and technology) are developed. This paper presents the outcome of a recently held workshop (29 November 1999) organised by the NATO C3 Agency and hosted by the European Telecommunication Standards Institute (ETSI). The agenda, report and presentations are available at http://www.nc3a.nato.int. This paper discusses ETSI specifically, but the arguments and principles also apply to other standards fora. It was proposed that there should be a coordinated action within the defense community of the Alliance with respect to civil standards which will encourage the emergence of a harmonised defense market for civil telecommunication products (COTS). This paper will discuss the possibilities and significance of defense requirements capture within the context of civil telecommunication standards development.
Author
Standardization; Commercialization; Telecommunication

20010019324 Industrieanlagen-Betriebsgesellschaft m.b.H., Ottobrunn, Germany
RISKS BY USING COTS PRODUCTS AND COMMERCIAL ICT SERVICES
Jantsch, Susanne, Industrieanlagen-Betriebsgesellschaft m.b.H., Germany; Commercial Off-the-Shelf Products in Defence Applications 'The Ruthless Pursuit of COTS'; December 2000, pp. 7-1 - 7-4; In English; See also 20010019317
Report No.(s): ISBN 92-837-1049-5; Copyright Waived; Avail: CASI; A01, Hardcopy

Among the requirements influencing today's procurement of new information and communications systems, the most prominent are cost effectiveness and the use of the latest developments in information and communications technology (ICT) through the whole lifetime of a system. This can no longer be achieved in procurement procedures as they used to be, with long planning and development phases, resulting in proprietary products based more and more often on out-dated technology at the time they go operational. Also, storage or provision of spare parts for and maintenance of such fully or mainly proprietary systems, as well as the education and training of personnel for their operation and maintenance, are increasingly cost intensive. The alternative and inevitable approach is the consequent use of Commercial Off-the-Shelf (COTS) products, allowing for easy and timely release changes and introduction of new hard and software versions when they come to market, paired with the consequent outsourcing of all those services which are available with

comparable or higher quality by non-military providers, allowing usually to choose among competitive offers. However, though on first view this new way of procurement seems to perfectly meet the above mentioned requirements for cost effectiveness and application of the latest ICT developments, there is also a new class of risks to be identified and dealt with. After summarizing the eminent advantages of the consequent use of COTS products and outsourcing, this paper will address the risks that have to be considered and finally point out methods to improve confidence in how to use 'unsecure' products and services.
Author
Telecommunication; Information Systems; Commercialization; Technology Utilization; Risk

20010019325 Alenia Marconi Systems, Rome, Italy
C31 SYSTEMS ACQUISITION AND MAINTENANCE IN RELATION TO THE USE OF COTS PRODUCTS
Rampino, S., Alenia Marconi Systems, Italy; Fiorilli, M., Alenia Marconi Systems, Italy; Commercial Off-the-Shelf Products in Defence Applications 'The Ruthless Pursuit of COTS'; December 2000, pp. 8-1 - 8-7; In English; See also 20010019317
Report No.(s): ISBN 92-837-1049-5; Copyright Waived; Avail: CASI; A02, Hardcopy

The paper attempts to highlight the main pros and cons of embedding Commercial Off-the-Shelf (COTS) products in military C31 Systems in the overall framework of Systems Acquisition and Maintenance, basing on Alenia Marconi Systems industrial experience. Significant programs are briefly outlined in this sense, providing the reader an opportunity to consider the issue from the 'practical' perspective.
Author
Information Systems; Commercialization; Systems Management; Computer Programs; Standardization

20010019334 AverStar, Inc., Jefferson, MD USA
DETERMINING THE SUITABILITY OF COTS FOR MISSION CRITICAL APPLICATIONS
Kohl, Ronald J., AverStar, Inc., USA; Commercial Off-the-Shelf Products in Defence Applications 'The Ruthless Pursuit of COTS'; December 2000, pp. 18-1 - 18-4; In English; See also 20010019317
Report No.(s): ISBN 92-837-1049-5; Copyright Waived; Avail: CASI; A01, Hardcopy

Commercial Off-the-Shelf (COTS) products are being considered for inclusion in ever more complex and critical systems. There are known advantages and risks for considering the use of COTS in complex systems. Yet, given the rigorous needs of Mission Critical systems or subsystems, there have begun to emerge concerns and risks about the suitability of COTS for such applications. This paper identifies some of the characteristics of Mission Critical systems (e.g. reliability, availability, correct functionality) that makes the selection process of COTS products (hardware, software, subsystems, etc.) an increasingly important factor in total system lifecycle phases (design, development, acceptance, operations/maintenance and disposal). This paper presents a set of risk areas related to the use of COTS, in general, and specifically for Mission Critical systems, that would assist both the acquisition community as well as the development/integration community in determining the suitability of using COTS in such Mission Critical systems. Then, a set of risk mitigation approaches is identified; some of which have been applied to certain National Aeronautics and Space Administration (NASA) programs. Lastly, a set of steps that could lead to the establishment of a set of procedures, and perhaps even an enterprise policy on if and/or when COTS products are suitable for certain Mission Critical applications.
Author
Computer Programs; Risk; Commercialization; Technology Utilization

20010019335 IBM Belgium, Brussels, Belgium
SIX FACETS OF THE OPEN COTS BOX
Dumas, Daniel H., IBM Belgium, Belgium; Commercial Off-the-Shelf Products in Defence Applications 'The Ruthless Pursuit of COTS'; December 2000, pp. 19-1 - 19-8; In English; See also 20010019317
Report No.(s): ISBN 92-837-1049-5; Copyright Waived; Avail: CASI; A02, Hardcopy

Although procurement of Commercial Off-the-Shelf (COTS) software for Defense applications has long included evaluation in terms of the products respect for standards and norms, actual experience has often revealed shortcomings in the ability to deploy solutions based on these packages widely over a period of time. We look here at what additional factors need to be considered in order to make the use of COTS software more likely to bring continuing benefits over the life of an application system. The six aspects that are considered in the paper are: (1) Presentation interfaces; (2) Release compatibility; (3) Portability; (4) Programming interfaces; (5) Security interfaces; and (6) Management interfaces.
Author
Computer Programs; Commercialization; Evaluation; Interfaces; Information Systems

20010019337 IBM Belgium, Brussels, Belgium
COTS BASED SYSTEMS: THE NECESSITY OF A SERVICE AND SYSTEMS MANAGEMENT STRATEGY TO ASSURE SERVICE LEVELS
Somerling, Dirk, IBM Belgium, Belgium; Commercial Off-the-Shelf Products in Defence Applications 'The Ruthless Pursuit of COTS'; December 2000, pp. 22-1 - 22-2; In English; See also 20010019317
Report No.(s): ISBN 92-837-1049-5; Copyright Waived; Avail: CASI; A01, Hardcopy

Commercial Off-the-Shelf (COTS) based systems create the need for system management strategy. In large military organizations, as in any traditional business organization, the collection of the tasks to be performed by every employee results in the service the organization provides. In order to perform his tasks at best, each employee needs a set of tools, which differs according to the task to be performed (e.g. phone, vehicle, etc.). In our particular subject, the employees rely on (a) computer(s) and on the applications and data accessed through or processed by his (several) computer(s).
Author
Management Planning; Systems Management; Commercialization; Computer Programs; Information Systems

20010092182 Research and Technology Organization, Systems Concepts and Integration Panel, Neuilly-sur-Seine, France
LOGISTICS TEST AND EVALUATION IN FLIGHT TEST *[LES ESSAIS ET L'EVALUATION DE LA LOGISTIQUE LORS DES ESSAIS EN VOL]*
Bourcier, Michael A., Air Force Flight Test Center, USA; August 2001; 102p; In English; CD-ROM contains full text document in PDF format; Original contains color illustrations
Report No.(s): RTO-AG-300-Vol-20; AC/323(SCI-010)TP/38-Vol-20; ISBN 92-837-1071-1; Copyright Waived; Avail: CASI; C01, CD-ROM; A06, Hardcopy; A02, Microfiche

The objective of this AGARDograph is to provide an introductory overview of logistics test and evaluation methods for supportability testing. This AGARDograph is an attempt to put into print the approach and techniques for a test team to execute logistics/supportability test and evaluation. To do so, the logistics/supportability test and evaluation process is subdivided into manageable functional areas and disciplines called Integrated Logistics Support (ILS) elements. The 10 ILS elements are: maintenance planning; manpower and personnel; support equipment; computer resources; facilities; packaging, handling, storage, and transportation; and design interface. Whether a program is a large one, like a new F-22 aircraft, or a small one, like a new 25K Loader, all logistics elements must be evaluated for applicability to the program. The only change between large and small programs is the depth of effort to be performed in each element. Examples will be provided to discuss the test and evaluation technique to each area and are adaptable to the reader's particular area of interest. This volume should complement the AG-300 Vol.13 on 'Reliability and Maintainability.'
Author
Logistics; Flight Tests; Support Systems; Evaluation

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DOCUMENTATION AND INFORMATION SCIENCE

20000061448 NASA Langley Research Center, Hampton, VA USA
DEVELOPMENT OF X-33/X-34 AEROTHERMODYNAMIC DATA BASES: LESSONS LEARNED AND FUTURE ENHANCEMENTS
Miller, C. G., NASA Langley Research Center, USA; Aerodynamic Design and Optimisation of Flight Vehicles in a Concurrent Multi-Disciplinary Environment; June 2000, pp. 32-1 - 32-12; In English; See also 20000061419; Copyright Waived; Avail: CASI; A03, Hardcopy

A synoptic of programmatic and technical lessons learned in the development of aerothermodynamic data bases for the X-33 and X-34 programs is presented in general terms and from the perspective of the NASA Langley Research Center Aerothermodynamics Branch. The format used is that of the 'aerothermodynamic chain,' the links of which are personnel, facilities, models/test articles, instrumentation, test techniques, and computational fluid dynamics (CFD). Because the aerodynamic data bases upon which the X-33 and X-34 vehicles will fly are almost exclusively from wind tunnel testing, as opposed to CFD, the primary focus of the lessons learned is on ground-based testing. The period corresponding to the development of X-33 and X-34 aerothermodynamic data bases was challenging, since a number of other such programs (e.g., X-38, X-43) competed for resources at a time of downsizing of personnel, facilities, etc., outsourcing, and role changes as NASA Centers served as subcontractors to industry. The impact of this changing environment is embedded in the lessons learned. From a technical perspective, the relatively long times to design and fabricate metallic force and moment models, delays in delivery of models, and a lack of quality assurance to determine the fidelity of model outer mold lines (OML) prior to wind tunnel testing had a major negative impact on the programs. On the positive side, the application of phosphor thermography to obtain global, quantitative heating distributions on rapidly fabricated ceramic models revolutionized the aerothermodynamic optimization of vehicle OMLs, control surfaces, etc. Vehicle designers were provided with aeroheating information prior to, or in conjunction with, aerodynamic information early in the program, thereby allowing trades to be made with both sets of input; in the past only aerodynamic data were available as input. Programmatically, failure to include transonic aerodynamic wind tunnel tests early in the assessment phase led to delays in the optimization phase, as OMLs required modification to provide adequate transonic aerodynamic performance without sacrificing subsonic and hypersonic performance. Funding schedules for industry, based on technical milestones, also presented challenges to aerothermodynamics seeking optimum flying characteristics across the subsonic to hypersonic speed regimes and minimum aeroheating. This paper is concluded with a brief discussion of enhancements in ground-based testing/CFD capabilities necessary to partially/fully satisfy future requirements.
Author
Aerodynamic Characteristics; Aerothermodynamics; Data Bases; Fabrication; Ground Tests; X-33 Reusable Launch Vehicle; X-34 Reusable Launch Vehicle; X-38 Crew Return Vehicle

20010003247 Royal Air Force Inst. of Aviation Medicine, UK
BATTLEFIELD INFORMATION SYSTEMS IN AIR WARFARE
Stapleton, G., Royal Air Force Inst. of Aviation Medicine, UK; Cook, Malcolm James, Abertay Univ., UK; Artman, Henrik, National Defence Coll., Sweden; Usability of Information in Battle Management Operations; November 2000, pp. 2-1 - 2-12; In English; See also 20010003245; Copyright Waived; Avail: CASI; A03, Hardcopy

Intelligence systems are designed to enable self-knowledge and knowledge of the opposition to achieve knowledge superiority. The basis for knowledge is the collection, collation, interpretation, and dissemination of information. Superior performance in the marshalling of information sources, the creation of shared knowledge and the projection of information in future plans represents what has been called information superiority. The design of any large-scale socio-technical system for sharing, processing, and managing information resources requires careful analysis in the development, implementation, and operation to ensure that the system contributes effectively to the performance it is intended to support. Many analyses of such systems focus on process variables without establishing their relationship to outcomes. What seems to be critical is the capacity to process information further to create the comprehension stressed by Endsley as a form of second level situation awareness. This is in accord with the view that the process of making or creating knowledge for decision making is more instrumental in preventing faulty decision making that processes of review given the time constraints of many military tasks. There are many examples in the literature where the processes of intelligence development, or operation, or both, have been poorly managed with catastrophic consequences. It can be argued that the reasons for such system level failures in socio-technical information systems can be traced to three perspectives that are inappropriately expressed in the design and operation. The first perspective concerns the users. The user is often denigrated in the development process as the root of many problems and the newly developed system(s) are intended to manage the user's behaviour to achieve greater levels of performance. Thus, so-called user-oriented design is only a rhetorical statement concerning the existence of contact with the user-population and not a guarantee of the effective elicitation of user requirements nor is it a tacit acknowledgement of the central role of users in the decision-making processes. The second perspective concerns the potential different user groups, or system clients, and the way that information sharing is prioritized among the different groups in relation to their air warfare roles. The third perspective concerns the effective operation of battlefield operations in a diverse range of contexts both in space-time and in composition. Failure to acknowledge the large array of factors that shape performance in the use of information systems can undermine the operation effectiveness of deployed systems. Indeed, it can be argues that operational issues and limited foresight in design can be good examples of the latent pathogens that may generate total system failure in the complex systems.
Author
Decision Making; Information Management; Information Systems; Warfare; Military Technology

20010003253 Romanian Joint Staff, Bucharest, Romania
CONSIDERATIONS ON INFORMATION OVERLOAD IN ELECTRONIC WARFARE
Craciun, L., Romanian Joint Staff, Romania; Usability of Information in Battle Management Operations; November 2000; 10p; In English; See also 20010003245; Original contains color illustrations; Copyright Waived; Avail: CASI; A02, Hardcopy

This paper presents some considerations regarding the information overload in electronic warfare, focusing on land-based tactical electronic systems. After a quick review of signal environment and signal processing tasks in electronic warfare, two particular cases are presented: (1) emitter identification and (2) evaluation and reporting. For these two cases, some solutions to reduce information overload are considered
Author
Electronic Warfare; Signal Processing; Emitters; Military Technology

20010003258 Naval Underwater Systems Center, Newport, RI USA
INTEGRATING INFORMATION FROM MULTIPLE SOURCES: EXPERT DECISION MAKING PROCEDURES
Kirschenbaum, Susan S., Naval Underwater Systems Center, USA; Usability of Information in Battle Management Operations; November 2000, pp. 15-1 - 15-9; In English; See also 20010003245
Contract(s)/Grant(s): NUWC Proj. A43322; ONR Proj. A42100; Copyright Waived; Avail: CASI; A02, Hardcopy

Battlespace Management systems are often developed by decomposing the problem into separate functions. For example, the battle scene is decomposed into intelligence reports, sensor displays for each sensor, contact tracks for each sensor contact, environmental (weather, oceanography) conditions and predictions, sensor effectiveness predictions, geophysical/physical oceanographic pictures, etc. Once the problem has been decomposed and analyzed, the decision maker must put it back together in a mental information fusion process, integrating information. The tools to help the expert decision maker re-fuse the problem are far fewer and more difficult to develop than the tools to decompose. The research reported here takes an alternative approach by providing information displays that cluster and integrate information according to the expert decision maker's knowledge schema and procedural structure. A complex, time-dependent (but non-military) test domain with multiple, conflicting goals was selected. Functional partitioning required greater effort

while procedurally based information-clustering resulted in more efficient (timely and accurate) decision making.
Author
Decision Making; Information Management; Information Systems; Display Devices

20010003260 FGAN, Research Inst. for Applied Natural Sciences, Wachtberg-Werthhoven, Germany
A CONCEPT FOR KNOWLEDGE-BASED USER SUPPORT IN NAVAL ENVIRONMENTS
Distelmaier, Helmut, FGAN, Germany; Doerfel, Gert, FGAN, Germany; Doering, Bernhard, FGAN, Germany; Usability of Information in Battle Management Operations; November 2000, pp. 17-1 - 17-8; In English; See also 20010003245; Copyright Waived; Avail: CASI; A02, Hardcopy

Technology pushes for sensor and weapon systems as well as for command, control, communication, and information systems have increased the amount and complexity of information available while the time to process that information has dramatically decreased. Additionally, recent changes in military situations and doctrines have given rise to the need for computer-based aids that can support human operators in getting situation awareness and reacting to novel complex and rapidly changing situations. A concept has been developed to support the members of the decision making team in combat information centers of the German Navy vessels by knowledge-based user interfaces. Such interfaces will ease the burden of the decision makers in all phases of the military command and control cycle and enhance the effectiveness of the decision making process in novel military scenarios, e.g., in Littoral Warfare, Crisis and Low Intensity Conflicts, or Missions other than War. The paper starts with a general problem description and a framework of operator support possibilities based on a hierarchical structure of human task performance with different levels of situational complexity. It follows the description of a generic support concept by means of knowledge-based user interfaces consisting of a knowledge-based assistance system and an interactive multimedia user interface. Finally, as an example the implementation of the conceptual work into a demonstrator of operator support in naval anti-air warfare situations is presented. With this demonstrator the effectiveness of decision making and action taking support by a knowledge-based user interface could be shown.
Author
Decision Making; Information Systems; Information Management; Military Technology

20010003262 Office of Naval Research, Human System Science and Technology Dept., Arlington, VA USA
INVESTIGATING THE INFORMATION PRESENTATION DESIGN SPACE
Gigley, Helen M., Office of Naval Research, USA; Usability of Information in Battle Management Operations; November 2000, pp. 20-1 - 20-8; In English; See also 20010003245; Copyright Waived; Avail: CASI; A02, Hardcopy

Military systems at all levels of decision making require the ability for the decision maker to find information, query it, seek refinement of it, process it in combination with other information, add value to it, make the decision and communicate the decision to another user. The US Office of Naval Research program in Interactive Multimedia and User-Centered Design supports research in how to employ technological capabilities to enhance a person's abilities to carry out the decision making objective. This paper will employ several research projects from this program to illustrate basic findings that impact how to design systems to meet this objective. Usability objectives require that design address the impact on the user's ability to perform the task. The research reported here, even though in domains or applications that differ from battle management are at the level of studies of enabling understanding of the design space. Reported results provide guidance and suggest how to design the information presentation in the appropriate form for its use. First, basic assumptions behind development of the program will be described to set the context for the projects. Then, each project will be summarized presenting the research findings. The selected projects provide scientific bases for design decisions that impact how a person can actually use information in different presentation contexts, multimedia documents, multidimensional flat panel displays, and in a Responsive Workbench context. Other research includes multiple modalities but will not be discussed here.
Author
Decision Making; Information Systems; Information Management; Technology Utilization; Military Technology

20010003263 FGAN, Research Establishment for Applied Natural Sciences, Wachtberg-Werthhoven, Germany
COMPONENTWARE APPROACHES IN MANAGEMENT INFORMATION SYSTEMS
Kaster, Juergen, FGAN, Germany; Kaster, Annette, FGAN, Germany; Usability of Information in Battle Management Operations; November 2000, pp. 21-1 - 21-6; In English; See also 20010003245; Copyright Waived; Avail: CASI; A02, Hardcopy

Modern command and control information systems (CCIS) are characterized by continuously changing conditions regarding technology, task and user profiles. As a consequence of this heterogeneity a huge amount of information and knowledge pieces of different data types has to be managed and processed in distributed communication networks. The situation in military CCIS is even more complex, regarding e.g. new requirements and multi-national command structures in actual out-of-area missions. The paper will focus on architecture models on the basis of 'componentware technology'. Pursuing the proposed ideas may help to design systems of high flexibility that can be adapted to actual user needs and task requirements.
Author
Command And Control; Communication Networks; Information Systems; Military Technology

20010009840 Instituto Nacional de Tecnica Aeroespacial, Aerodynamics Div., Madrid, Spain
PRESENTATION OF THE DATABASE
RuizCalavera, Luis P., Instituto Nacional de Tecnica Aeroespacial, Spain; Verification and Validation Data for Computational Unsteady Aerodynamics; October 2000, pp. 1-8; In English; See also 20010009839; Copyright Waived; Avail: CASI; A02, Hardcopy

With the continuous progress in hardware and numerical schemes, Computational Unsteady Aerodynamics (CUA), that is, the application of Computational Fluid Dynamics (CFD) to unsteady flowfields, is slowly finding its way as a useful and reliable tool (turbulence and transition modeling permitting) in the aircraft, helicopter, and missile design and development process. Before a specific code may be used with confidence it is essential to validate its capability to describe the physics of the flow correctly, or at least to the level of approximation required, for which purpose a comparison with accurate experimental data is needed. Unsteady wind tunnel testing is difficult and expensive; two factors which limit the number of organizations with the capability and/or resources to perform it. Thus, unsteady experimental data is scarce, often restricted and scattered in diverse documents. Additionally, access to the reports does not necessarily assure access to the data itself The present publication was conceived with the aim of collecting into a single easily accessible document as much of the good quality data as possible. The idea is not new. In 1982 ACARD's Structures and Material Panel (SMP) produced the AGARD Report No. 702 'Compendium of Unsteady Aerodynamic Measurements', which has found and continues to find extensive use within the CUA community. Report 702 is primarily focused on aeroelasticity, with particular attention paid to transonic conventional flutter. In 1995 AGARD#s Fluid Dynamics Panel (FDP) decided to update and expand the former database with new geometries and physical phenomena and launched Working Group WG-22 on 'Validation Data for Computational Unsteady Aerodynamic Codes', Shortly afterwards AGARD was reorganized as the RTO (Research and Technology Organization) and the WG was renamed as AVT (Applied Vehicle Technology) WG-003. The group, chaired by the author of this introductory chapter, first met in spring 1997 and closed its effort 5 meetings later in spring 1999 with the present publication. Special care was taken that both theoreticians and experimentalists were represented in the Working Group. Table 1 gives the complete list of WG members including address, telephone, fax and e-mail. Other contributors who were not formal members of the group are identified as authors of individual chapters.
Author
Aeroelasticity; Computational Fluid Dynamics; Facsimile Communication; Flow Distribution; Turbulence Models; Unsteady Aerodynamics

20010019331 Defence Evaluation Research Agency, Malvern, UK
THE CONVERGENCE OF MILITARY AND CIVIL APPROACHES TO INFORMATION SECURITY?
Rowlingson, Robert, Defence Evaluation Research Agency, UK; Commercial Off-the-Shelf Products in Defence Applications 'The Ruthless Pursuit of COTS'; December 2000, pp. 15-1 - 15-6; In English; See also 20010019317
Report No.(s): ISBN 92-837-1049-5; Copyright Waived; Avail: CASI; A02, Hardcopy

The motivation for this paper is the about-turn that defense computing went through with open systems interconnection (OSI) and Ada. Defense specific products and bespoke development were discarded as the cost-benefits of mainstream COTS systems became far superior. This paper shows that a similar situation is developing in information security (infosec) and suggests that the defence approach to security may need to adapt if it is to benefit from the rapidly growing commercial market.
Author
Security; Information Systems; Commercialization; Risk; Technology Utilization

20010019333 Naval Postgraduate School, Monterey, CA USA
THE RUTHLESS PURSUIT OF THE TRUTH ABOUT COTS
Schneidewind, Norman F., Naval Postgraduate School, USA; Commercial Off-the-Shelf Products in Defence Applications 'The Ruthless Pursuit of COTS'; December 2000, pp. 17-1 - 17-9; In English; See also 20010019317
Report No.(s): ISBN 92-837-1049-5; Copyright Waived; Avail: CASI; A02, Hardcopy

We expose some of the truths about Commercial Off-the-Shelf (COTS) products, discounting some exaggerated claims about the applicability of COTS, particularly with regard to using COTS in safety critical systems. Although we agree that COTS has great potential for reduced development and maintenance time and cost, we feel that the advocates of COTS have not adequately addressed some critical issues concerning reliability, maintainability, availability, requirements risk analysis, and cost. Thus we illuminate these issues, suggesting solutions in cases where solutions are feasible and leaving some questions unanswered because it appears that the questions cannot be answered due to the inherent limitations of COTS. These limitations are present because there is inadequate visibility and documentation of COTS components.
Author
Computer Programs; Commercialization; Reliability; Risk; Availability

20010047042 Research and Technology Organization, Information Systems Technology Panel, Neuilly-sur-Seine, France
NEW INFORMATION PROCESSING TECHNIQUES FOR MILITARY SYSTEMS *[LES NOUVELLES TECHNIQUES DE TRAITEMENT DE L'INFORMATION POUR LES SYSTEMES MILITAIRES]*
April 2001; 300p; In English; New Information Processing Techniques for Military Systems; 9-11 Oct. 2000, Istanbul, Turkey; See also 20010047043 through 20010047072; CD-ROM contains full text document in PDF format; Original contains color illustrations
Report No.(s): RTO-MP-049; AC/323(IST-017)TP/8; ISBN 92-837-1061-4; Copyright Waived; Avail: CASI; A13, Hardcopy; A03, Microfiche; C01, CD-ROM

This volume contains the Technical Evaluation Report, 2 Keynote Addresses and 29 unclassified papers, presented at the Information Systems Technology Panel Symposium held in Istanbul, Turkey, 9-11 October 2000. The papers were presented under the following headings: Information Systems and Techniques I; Information Systems and Techniques II; Security and Reliability; Communications; Detection, Fusion, Decision Support; and Virtual Reality and Human-Computer Interface.
Author
Conferences; Data Processing; Information Systems; Military Operations; Command And Control; Multisensor Fusion; Fuzzy Systems; Decision Making

20010047043 Physics and Electronics Lab. TNO, The Hague, Netherlands
INFORMATION EXCHANGE IN SUPPORT OF C2-INTEROPERABILITY
Driesenaar, Freek N., Physics and Electronics Lab. TNO, Netherlands; New Information Processing Techniques for Military Systems; April 2001, pp. 1-1 - 1-8; In English; See also 20010047042; Copyright Waived; Avail: CASI; A02, Hardcopy

Large organizations, such as NATO and the armed forces of its member countries, cannot function without the availability of accurate, timely, complete and consistent information. The quality of every decision that is made depends largely on the quality of the information on which the decision is based. This makes information an essential resource for any organization that must be managed carefully. Due to the intensified level of co-operation between NATO countries, it has become crucial that information can also be shared between armed forces. National forces are deployed ever more often in crisis management situations and (disaster-)relief operations throughout the world, requiring them to work together closely with forces of other countries. Fast and effective collaboration requires a method for information dissemination that is flexible and open. The need to share information between countries translates directly to the requirement that information can be exchanged between their command & control (C2) systems. For this to be possible, the systems must agree to exchange and interpret information. in a standardised (unambiguous) way. In other words: the systems must he interoperable. This paper focuses on two existing information exchange standards: ADatP-3 (based on formatted messages) and ATCCIS (based on database replication). After describing and analysing both ADatP-3 and ATCCIS separately, the paper compares the two information exchange standards. Ideas are set forward for a unified approach which tries to capture the best of the two worlds and the paper ends with suggestions for future work.
Derived from text
Selective Dissemination Of Information; Information Transfer; Information Flow; Standardization

20010047044 National Aerospace Lab., Amsterdam, Netherlands
POTENTIALS OF ADVANCED DATABASE TECHNOLOGY FOR MILITARY INFORMATION SYSTEMS
Choenni, Sunil, National Aerospace Lab., Netherlands; Bruggeman, Ben, Royal Netherlands Naval Coll., Netherlands; New Information Processing Techniques for Military Systems; April 2001, pp. 2-1 - 2-11; In English; See also 20010047042; Copyright Waived; Avail: CASI; A03, Hardcopy

Research and development in database technology evolves in several directions, which are not necessarily divergent. A number of these directions might be promising for military information systems as well. In this paper, we discuss the potentials of multi-media databases and data mining. Both directions focus on the handling of a vague information need of a user. In general, data mining systems allow a higher degree of vagueness than multi-media systems. Information systems that are able to handle vague information needs adequately will improve the decision making process of militaries.
Author
Data Bases; Data Mining; Genetic Algorithms; Data Base Management Systems

20010047045 Industrieanlagen-Betriebsgesellschaft m.b.H., Ottobrunn, Germany
INFORMATION PROCESSING AS A KEY FACTOR FOR MODERN FEDERATIONS OF COMBAT INFORMATION SYSTEMS
Krusche, Stefan, Industrieanlagen-Betriebsgesellschaft m.b.H., Germany; Tolk, Andreas, Industrieanlagen-Betriebsgesellschaft m.b.H., Germany; New Information Processing Techniques for Military Systems; April 2001, pp. 3-1 - 3-8; In English; See also 20010047042; Original contains color illustrations; Copyright Waived; Avail: CASI; A02, Hardcopy

Building flexible collaborations of different heterogeneous military units just in time is one of the key factors to perform joint and combined operations successfully, It is one of the most important prerequisites to and challenges for information systems to support these collaborations with user-adapted information to the warfighter where it is needed. For information systems, this is a requirement to adequately build federations of different and heterogeneous data and information sources on the basis of the existing data bases. This objective is only achieved by a new approach towards information sharing based on data mediation techniques which enable the configuration for different information systems towards a global information source to support military business processes across systems, nations and unit borders. One of the key factors for data mediation techniques is, that it is not an isolated technical solution to

gain interoperability between different information systems, but is integrated in an overall data management process, which produces standard business objects for data exchange and standard mediation rules to configure the technical solution. In NATO, this process already has started in form of respective NATO Data Administration Group (NDAG) activities, that aims; at the development of standardized data elements. Data Mediation means to establish federations of heterogeneous data sources on the basis of a common data exchange format while the data and systems itself are kept where and as they are. In other words, on the basis of the data administration and management processes the integration of legacy systems becomes possible without having to change the systems itself. This paper provides an over-view of this new integration technique and its relation to already ongoing NATO activities.
Author
Data Management; Data Processing; Data Systems

20010047046 Forschungsgesellschaft fuer Angewandte Naturwissenschaften, Werthoven, Germany
ARCHITECTURE FOR FLEXIBLE COMMAND AND CONTROL INFORMATION SYSTEMS (INFIS)
Wunder, M., Forschungsgesellschaft fuer Angewandte Naturwissenschaften, Germany; New Information Processing Techniques for Military Systems; April 2001, pp. 4-1 - 4-6; In English; See also 20010047042; Original contains color illustrations; Copyright Waived; Avail: CASI; A02, Hardcopy

Next generation CCIS will be leaner and more flexible. The previous trend to decentralize the computer power increased the complexity of local devices. Now it is more and more difficult to achieve the requirements of higher mobility and simpler access to information services.
Derived from text
Command And Control; Information Systems; Systems Management

20010047048 Defence Evaluation Research Agency, Portsdown, UK
CHALLENGES FOR JOINT BATTLESPACE DIGITIZATION (JBD)
Hamid, S., Defence Evaluation Research Agency, UK; White, I., Defence Evaluation Research Agency, UK; Gibson, C., Defence Evaluation Research Agency, UK; New Information Processing Techniques for Military Systems; April 2001, pp. 6-1 - 6-13; In English; See also 20010047042; Original contains color illustrations; Copyright Waived; Avail: CASI; A03, Hardcopy

This paper highlights several important areas in achieving extensive integration of military command and control systems. The discussion in the paper focuses on two areas where technology per se is deficient, and that must be considered carefully against the stronger tides of technology push in systems design and acquisition. These areas are the human factors aspects of system design, and the challenge of information management.
Author
Military Operations; Command And Control; Digital Techniques

20010047049 AURA Ltd., Brno, Czech Republic
INFORMATION SYSTEM FOR LOGISTICS: MODERN TOOL FOR LOGISTICIANS
Burival, Zdenek, AURA Ltd., Czech Republic; Reha, Jaroslav, Army of the Czech Republic, Czechoslovakia; New Information Processing Techniques for Military Systems; April 2001, pp. 7-1 - 7-6; In English; See also 20010047042; Copyright Waived; Avail: CASI; A02, Hardcopy

The article in its first part characterizes main features, capabilities and architecture of the Information System for Logistics (ISL). The second part describes the way and main principles used for building the ISL. The authors used in the article their experience acquired during their work in the joint development team of the ISL built for the Ministry of Defense and the Army of the Czech Republic.
Author
Information Systems; Logistics; Maintenance; Logistics Management

20010047050 Federal Armed Forces Univ., Inst. for Applied Systems Science and Operations Research, Munich, Germany
ON THE DEVELOPMENT OF COMMAND AND CONTROL MODULES FOR COMBAT SIMULATIONS MODELS ON BATTALION DOWN TO SINGLE ITEM LEVEL
Hofmann, Hans W., Federal Armed Forces Univ., Germany; Hofmann, Marko, Federal Armed Forces Univ., Germany; New Information Processing Techniques for Military Systems; April 2001, pp. 8-1 - 8-12; In English; See also 20010047042; Copyright Waived; Avail: CASI; A03, Hardcopy

The paper contains an overview on the design principles and main characteristics of a family of new, strictly object-oriented combat simulation models called COSIMAC (COmbat SImulation Model with Automated Control), developed at our Institute since 1995. They are designed as closed models which means, that a detailed modeling of the highly complicated CI processes is indispensible. Additionally, the option of an interactive man/machine interface is implemented, which offers the possibility of manual control on different command & control levels for playing against computer generated (and controlled) forces, for experimenting with 'unconventional' decisions, and for developing and improving the rule system in a trial-and-error fashion. Furthermore, the paper describes a general architecture for the design of command & control modules, which offers the possibility of describing tactical/operational intentions and concepts of operation in a kind of battle management language (multilayer tactical language concept), the terrain representation, attrition and movement modeling, the development of terrain and situation assessment modules, which are - together with a set of so-called planning functions and spatial and procedural templates - a prerequisite for the rule systems that generate adequate tactical missions and orders for the assigned units or simulated objects, and, finally, the main results, conclusions and future developments of the project.
Author
Command And Control; Combat; Simulation; Models; Automatic Control

20010047051 Military Technical Inst. of Electronics, Prague, Czech Republic
THE CZECH APPROACH IN THE DEVELOPMENT OF A NATO INTEROPERABLE GROUND FORCES TACTICAL COMMAND AND CONTROL SYSTEM
Snajder, Milan, Military Technical Inst. of Electronics, Czech Republic; Horak, Jaroslav, Military Technical Inst. of Electronics, Czech Republic; Jindra, Vaclav, DeIINFO s.r.o., Czech Republic; Nesrsta, Ladislav, DeIINFO s.r.o., Czech Republic; New Information Processing Techniques for Military Systems; April 2001, pp. 9-1 - 9-9; In English; See also 20010047042; Original contains color illustrations; Copyright Waived; Avail: CASI; A02, Hardcopy

This paper describes systems engineering and system architecture design and development of the Ground Forces Tactical Command and Control System (GF-TCCS) of the Army of the Czech Republic. The design objective of the GF-TCCS is to provide automation support to commanders and their staff, based on the mission and phase of operations. The objective system will use a high proportion of commercial-off-the-shelf networking software, GIS products and government-off-the-shelf equipment, including military mobile radios and switches, tactical platforms (e.g. trucks, containers, armored personal carriers).
Author
Computer Systems Design; Architecture (Computers); Software Development Tools; Software Engineering; Computer Programs

20010047052 Federal Armed Forces Univ., Inst. for Geo Information and Land Development, Munich, Germany
PRINCIPLES AND APPLICATION OF GEOGRAPHIC INFORMATION SYSTEMS AND INTERNET/INTRANET TECHNOLOGY
Reinhardt, Wolfgang, Federal Armed Forces Univ., Germany; New Information Processing Techniques for Military Systems; April 2001, pp. 10-1 - 10-10; In English; See also 20010047042; Original contains color illustrations; Copyright Waived; Avail: CASI; A02, Hardcopy

The paper presented consists of three main parts. In the first part we roughly outline the state of the art of Geographic Information Systems (GIS) mainly with respect to technology and data. Within this part we also give some examples where GIS is applied in military applications. The second part gives an overview of architectures and some technical aspects of GIS-Internet/Intranet solutions, compares the different approaches and discusses the potential of this technology in general. Furthermore some examples demonstrate the prac-

tical use of GIS and Internet/Intranet. As the World Wide Web (WWW) gains more and more significance and there is a large demand of GIS applications in the Internet/Intranet we introduce the main principles of this technology. Especially we explain how Geographic Information Systems can be connected to the world wide web and which extensions are necessary to transfer and to view Geographic data. In this part we also show how the Virtual Reality Modelling Language (VRML) can be used in this field. Part of this is based on results of some projects conducted for the AMilGeo (Amt fur Militarisches Geowesen) of the German Federal Armed Forces as well as on other civilian projects. In the third part of the paper we demonstrate the potential of the GIS and Internet/Intranet technology for civilian and military applications. Besides we discuss the main advantages of GIS and Internet/Intranet, such as Ease of Use or the possibility to access up-to-date information in various databases. Furthermore we show how the connection of Internet and telecommunication can be used in GIS.
Author
Geographic Information Systems; Internets; World Wide Web; Data Transfer (Computers)

20010047054 Aptima, Inc., Woburn, MA USA
MODEL-BASED DESIGN OF INFORMATION-RICH COMMAND ORGANIZATIONS
Serfaty, Daniel, Aptima, Inc., USA; New Information Processing Techniques for Military Systems; April 2001, pp. KN2-1 - KN2-11; In English; See also 20010047042; Original contains color illustrations; Copyright Waived; Avail: CASI; A03, Hardcopy

This paper describes a breakthrough organization/team design method-a systematic, formal, quantitative approach to designing a team that best fits the mission to be accomplished. The Team Integrated Design Environment (TIDE) is a tool set designed to support this method, enabling the quantitative definition of requirements for command teams operating in complex mission environments. The TIDE methods and tools represent a powerful methodology to create novel organizational structures, based on operational mission variables, using quantitative methods. We know of no other methods that provide a similar formal framework for this type of design. This paper explains what it means to design a team or an organization and describes the TIDE method for team design. Then it presents some initial empirical results that indicate that optimally designed teams can outperform teams that use more traditional organizational structures, and discusses how the team design process must be altered to focus on different concerns, depending on the nature of the team being designed and the environment in which that team must function.
Derived from text
Design Analysis; Teams; Organizations; Command And Control

20010047056 Centre d'Etudes et de Recherches, Toulouse, France
SECURITY ARCHITECTURES FOR COTS BASED DISTRIBUTED SYSTEMS
Bieber, Pierre, Centre d'Etudes et de Recherches, France; Siron, Pierre, Centre d'Etudes et de Recherches, France; New Information Processing Techniques for Military Systems; April 2001, pp. 13-1 - 13-7; In English; See also 20010047042
Contract(s)/Grant(s): CTI-971B552; Copyright Waived; Avail: CASI; A02, Hardcopy

The paper describes two experiments in the design of security architectures for distributed systems that are implemented with Commercial Off The Shelf components. We added security components to protect information exchanged in a Distributed Interactive Simulation environment. We added a role-based access control component to a Workflow tool implemented with CORBA technologies. The two experiments followed the same approach that includes four steps (threat analysis, security policy definition, selection of security components and architecture efficiency evaluation).
Author
Computer Information Security; Access Control; Data Transmission; Architecture (Computers); Computer Systems Design

20010047057 Military Technical Academy, Computer Engineering Dept., Bucharest , Romania
DESIGN ASPECTS IN A PUBLIC KEY INFRASTRUCTURE FOR NETWORK APPLICATIONS SECURITY
Patriciu, Victor-Valeriu, Military Technical Academy, Romania; Serb, Aurel, Military Technical Academy, Romania; New Information Processing Techniques for Military Systems; April 2001, pp. 14-1 - 14-12; In English; See also 20010047042; Original contains color illustrations; Copyright Waived; Avail: CASI; A03, Hardcopy

Computer security is a vitally important consideration in modem systems. Typically, the military and banking areas have had detailed security systems. This paper will concentrate on an interesting area of software security based on public key cryptographic technology. The Public Key system makes it possible for two parties to communicate securely without either having to know or trust the other party. This is possible because a third party that both the other parties trust identifies them, and certifies that their keys are genuine. This third party is called the Certification Authority, or CA. CA guarantees that they are who they claim to be. The CA does this by registering each user's identification information, and issuing them with a set of Private keys and a set of Public Key Certificates. A worldwide Public Key Infrastructure (PKI) that supports international, government, and state policies/regulations will not be available in the near future. In the meantime, organizations and corporations can utilize this security technology to satisfy current business needs. Many organizations are choosing to manage their own Certificate Authority (CA) instead of outsourcing this function to a third party (i.e., Verisign, Thawte, GTE CyberTrust, GlobalSign). Our paper try to analyse the main design issues for a Public Key Infrastructure (PKI), needed to secure the most important network applications: Web access authentication and server-client communication confidentiality, VPN over Internet implementation, secure (signed) document and e-mail interchange.
Author
Computer Information Security; Communication Networks; Warning Systems; Certification

20010047058 Technische Univ., Inst. fuer Informatik, Munich, Germany
DEVELOPING CORRECT SAFETY CRITICAL, HYBRID, EMBEDDED SYSTEMS
Pretschner, Alexander, Technische Univ., Germany; Slotosch, Oscar, Technische Univ., Germany; Stauner, Thomas, Technische Univ., Germany; New Information Processing Techniques for Military Systems; April 2001, pp. 15-1 - 15-12; In English; See also 20010047042; Copyright Waived; Avail: CASI; A03, Hardcopy

Several aspects of the development process of correct safety critical discrete and hybrid embedded systems are discussed. The general process and its support by the CASE tool AUTOFOCUS is outlined. This is illustrated along the lines of a simplified version of NASA's Mays Polar Lander. It is argued that specific aspects of hybrid systems do require the modification of classical theories on software development, and these modifications are discussed. The paper concludes by focusing on one part of the development process, namely testing. A novel approach to the automated generation of test cases for discrete as well as hybrid systems is presented. The Mars lander's crash serves as an example for the derivation of meaningful test cases.
Author
Software Development Tools; Computer Programming; Safety

20010047063 Defence Evaluation Research Agency, Malvern, UK
AN OVERVIEW OF INFORMATION FUSION
Whitaker, G. D., Defence Evaluation Research Agency, UK; New Information Processing Techniques for Military Systems; April 2001, pp. 20-1 - 20-8; In English; See also 20010047042; Original contains color illustrations; Copyright Waived; Avail: CASI; A02, Hardcopy

This paper provides an introduction to, and overview of, the field of information fusion within a wider data and information fusion and processing context. It starts by considering the aims and objectives of research and development programmes in this area. In particular, asking what are we trying to achieve by such fusion from the end user (military commander?) point of view. The main emphasis of the paper is on military systems and reference is made to work at the UK's Defence Evaluation and Research Agency (DERA) for examples but the paper has more general relevance. Some of the common operational and logistical difficulties associated with current information fusion systems are highlighted. In other words, 'Why is making sense of data difficult?'' The differences and similarities between data and information and between their fusion and processing are discussed. The role of information fusion systems is to

address some or all of these difficulties and so provide more effective systems for a range of different applications and users. The means by which this is accomplished is then described in terms of fusing information at various levels of abstraction. Reference is made to models, architectures and frameworks that have been developed independently within the USA and the UK and that help structure and clarify the whole process. Current research aims to further improve our capabilities in this important, force-multiplying technology. Some people and nations aspire to information dominance in modem conflicts and the same can be said for modem businesses. To achieve or even approach this goal requires a vigorous and healthy research programme. Some of the current key research activities in this area are summarized. Most of this research is targeted on specific, near-term applications. The paper concludes with a personal perspective on the main future, longer-term research challenges.
Author
Information Systems; Information; Research And Development

20010047064 Defence Evaluation Research Agency, Fareham, UK
PROCESSING AND FUSION OF ELECTRO-OPTIC INFORMATION
Davies, I., Defence Evaluation Research Agency, UK; New Information Processing Techniques for Military Systems; April 2001, pp. 21-1 - 21-5; In English; See also 20010047042; Copyright Waived; Avail: CASI; A01, Hardcopy

The UK Defence Evaluation and Research Agency (DERA) has been researching over many years the use of knowledge-based techniques for the automation of information fusion within combat management systems functions. All-source automated data fusion techniques have successfully been demonstrated at the platform level and are currently embodied in a testbed called CMISE (Combat Management Integrated Support Environment). This makes use of own platform sensor data and tracks from other platforms via data-link for the automatic construction of the platform's tactical picture. The Data Fusion Module (DIM) within CMISE correlates at two levels, track and multi-track. Track correlation joins tracks from similar sources to form multi-tracks and multi-track correlation joins multi-tracks (from dissimilar sources) to form vehicles. Tracks and multi-tracks are correlated by a rule-based system using multi-hypothesis techniques supported by probability based algorithms. The data sources currently correlated by CMISE are radar, Electronic Support Measures (ESM), data-link, sonar, Identification Friend or Foe (IFF), plans and geographic information. This paper describes the modelling of an EO sensor and the effects of including data from such sensors in a fused tactical picture. DERA has been evolving the capabilities of CMISE in support of the applied research programme for over ten years. The requirement for a substantial increase in the level of automated support system comes from: a rapid increase in the amount of data available to Command. More sensors are available, producing more data; in the drive to improve the extent and quality of tactical information, automated methods are potentially faster, more reliable and more consistent than manual methods; increases in hostile target mobility and weapon lethality particularly in the littoral battlespace, stressing the importance of accurate and timely identification of targets; pressures to reduce platform through-life costs, particularly through reduction of manning. As well as addressing the above issues, automating the tactical picture compilation process allows operators to focus attention on situation assessment and resource allocation (actually fighting the ship) instead of being consumed by the mundane and repetitive track fusion and identification tasks for which automation is more suited.
Derived from text
Electro-Optics; Support Systems; Management Systems; Automatic Control; Iff Systems (Identification); Multisensor Fusion; Data Processing

20010059206 Research and Technology Organization, Information Systems Technology Panel, Neuilly-sur-Seine, France
VISUALISATION OF MASSIVE MILITARY DATASETS: HUMAN FACTORS, APPLICATIONS, AND TECHNOLOGIES *FINAL REPORT [LA VISUALISATION D'ENSEMBLES VOLUMINEUX DE DONNEES MILITAIRES: FACTEURS HUMANINS, APPLICATIONS ET TECHNOLOGIES]*
May 2001; 162p; In English; Original contains color illustrations; CD-ROM contains full text document in PDF format
Report No.(s): RTO-TR-030; AC/323(IST-013)TP/9; IST-013/RTG-002; ISBN 92-837-1066-5; Copyright Waived; Avail: CASI; C01, CD-ROM; A08, Hardcopy; A02, Microfiche

This final report of IST-013/RTG-002 'Visualization of Massive Military Datasets' presents some of the issues involved in visualisation as well as techniques that have been used in support of visualization for military applications. These issues are examined from three viewpoints: issues relating to human abilities and requirements, issues of data and of display technology, and issues relating to exemplary applications. Visualisation is seen to be something that happens in the mind of a human, not on the screen of a display. Effective visualization requires the users to interact closely with visual, auditory and perhaps haptic displays. IST-013/RTG-002 has accepted a reference model developed by IST-005, its predecessor group. The IST-005 Reference Model describes three loops of interaction between human and machine, an outermost loop that is the 'Why', a middle loop that is the 'What', and an inner loop that is the 'How' of visualisation. Since it is the human who visualizes, the central questions concern the human factors of the visualisation process. Important among these questions are the purposes of the users, together with the sensory and cognitive capabilities and limitations of humans. We identify four classes of purpose: Monitoring/controlling, Alerting, Searching, and Exploring. These purposes have different implications for the displays and the input devices, as well as for the engines that process the data. Chapter 3 of this report attempts a simple taxonomy of the kinds of data that might be involved in visualization. Finally, it is not enough simply to construct a visualisation system. It must be evaluated. Chapter 8 of the report discusses how this may be done.
Author
Data Processing; Display Devices; Human Factors Engineering; Data Bases

20010082354 i2 Technologies, Inc., Yorba Linda, CA USA
LEVERAGING NEW INFORMATION TECHNOLOGIES TO MANAGE OBSOLESCENCE
Baca, Malcolm, i2 Technologies, Inc., USA; Strategies to Mitigate Obsolescence in Defense Systems Using Commercial Components; June 2001, pp. 31-1 - 31-17; In English; See also 20010082326; Original contains color illustrations; Copyright Waived

In the new economy of digital technology the transition rate of component level functionality is transitioning at an accelerated rate introducing greater functional complexity. As voltage output scales downward and micron line width design rules are reduced there are new generations of digital technology that offer superior functionality that is more reliable, uses less power, less real state, less weight, and smaller power supplies. The newer generations of component technology are rapidly causing the older generations of component technology to become obsolete because the cost of various functionality commodity groups are reduced with the scaled down designs. At i2 through our global semiconductor library maintenance we are recording 37,000 component discontinuance notifications on an annual basis. Within the digital category a new generation of microprocessors is being introduced every 18 months and a new generation of memory type devices is being introduced every nine months with speed and density increases. This high rate of technology transition is impacting the production and spares support to sustain weapon systems that require ten, twenty, thirty or more years of operational support.
Derived from text
Technology Utilization; Computer Components

20010082355 Zrinyi Miklos National Defence Univ., Budapest, Hungary
A QUASI-COPYSAFE SECURITY OF DOCUMENTS ON NORMAL PAPERSHEETS
Mezey, Gyula, Zrinyi Miklos National Defence Univ., Hungary; Strategies to Mitigate Obsolescence in Defense Systems Using Commercial Components; June 2001, pp. 32-1 - 32-7; In English; See also 20010082326; Copyright Waived; Avail: CASI; A02, Hardcopy

A combination of 2D barcode with digital signature and normal text with polygonal watermark is proposed. Against synchronization attacks the watermark reference points are also included in the 2D barcode and secured by a digital signature, whilst the 2D barcode block(s) are embedded in the text.
Author
Security; Signatures

20020016329 Research and Technology Organization, Information Systems Technology Panel, Neuilly-sur-Seine, France
INFORMATION MANAGEMENT CHALLENGES IN ACHIEVING COALITION INTEROPERABILITY *[LES DEFIS DE LA GESTION DE L'INFORMATION DANS LA MISE EN OEUVRE DE L'INTEROPERABILITE AU SEIN D'UNE COALITION]*
December 2001; 302p; In English; 28-30 May 2001, Quebec, Canada; See also 20020016330 through 20020016354; CD-ROM contains full text document in PDF and PowerPoint format; Original contains color illustrations
Report No.(s): RTO-MP-064; AC/323(IST-022)TP/11; ISBN 92-837-1078-9; Copyright Waived; Avail: CASI; C01, CD-ROM; A14, Hardcopy; A03, Microfiche

Increasingly, sensor Unmanned Aerial Vehicles (UAV) are utilized to gather intelligence data, and combat UAVs are being proposed as complementing manned aircraft. In addition, alternative operations concepts are being proposed for the cooperative use of manned and unmanned aerial vehicles. The workshop achieved its objectives of identify requirements and technical issues. It defined and, to some extent prioritized, key areas to be addressed by the follow-on RTO (Research and Technology Organization) SCI-124 Task Group on the same subject. It established the need for architectures that enable interoperability in NATO (North Atlantic Treaty Organization) mixed manned and unmanned air operations, as current approaches were unlikely to accomplish this task well. This would allow better battle management and C4ISR, as well as the basis for dynamic planning, monitoring and intervention. The workshop highlighted the need to define the concept of operations, including rules of engagement and command and control hierarchy, before defining architectures.
Author
Pilotless Aircraft; Information Management; Conferences; Military Operations; Armed Forces

20020016330 Dalhousie Univ., Global Information Networking Inst., Halifax, Nova Scotia Canada
PLANNING FOR INTEROPERABILITY
Gentleman, W. Morven, Dalhousie Univ., Canada; Information Management Challenges in Achieving Coalition Interoperability; December 2001, pp. 1-1 - 1-9; In English; See also 20020016329; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

Interoperability is a major concern for NATO (North Atlantic Treaty Organization). In addition to the focus of this meeting, on facilitating coalition operations, interoperability is crucial to several other themes of research undertaken by the IST (Information Systems Technology) Panel, such as use of COTS (commercial off-the-shelf) products in larger systems or following an Evolutionary Software Development process. In coalitions, the C2 (command and control) systems of one nation may want to take advantage of information and services available from the systems of other nations, correspondingly they may want to make available information and services to the systems of other nations. The challenge is that because of the independent development, these exchanges may not fit directly, but must accommodate the different perspectives that have been taken on the abstractions they represent in the different systems.
Author
Information Systems; Interoperability; North Atlantic Treaty Organization (NATO); International Cooperation

20020016331 Defence Scientific Technology Lab., Integrated Systems Sector, Malvern, UK
STANDARD OR STANDARDS? SOME ISSUES TO CONSIDER IN THE USE OF META-DATA FOR COALITION OPERATIONS
Miles, Jonathan, Defence Scientific Technology Lab., UK; Braim, Stephen, Defence Scientific Technology Lab., UK; Furze, Richard, Defence Evaluation Research Agency, UK; Peck, Mathew, Defence Evaluation Research Agency, UK; Information Management Challenges in Achieving Coalition Interoperability; December 2001, pp. 2-1 - 2-27; In English; See also 20020016329; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

This paper discusses the issues that need to be addressed to allow the unambiguous exchange of information between coalition forces during multi-national operations. It analyzes the problems caused by a lack of common meta-data vocabulary between nations. The paper considers current initiatives to define meta-data standards within the UK, and describes a putative approach to yield inter-government interoperability. It then extends the work undertaken within UK and considers its potential to provide interoperability between nations operating within a coalition. Centralized, Decentralized and Federated approaches to meta-data interoperability are described and issues associated with each approach are highlighted. The Federated approach, consisting of a common core supplemented by local meta-data sets, appears to offer the best conceptual solution to coalition interoperability as it offers a common naming scheme tag set which provides additional extensibility and will allow for an interface to existing national naming scheme initiatives. This will provide a degree of centralized control with flexibility for individual organizational unit needs.
Author
Interoperability; Information Systems; International Cooperation; Information Transfer; Standards

20020016332 Cigital, Inc., Dulles, VA USA
COMMERCIAL OFF-THE-SHELF SOFTWARE COMPONENT INTEROPERABILITY
Voas, Jeffrey, Cigital, Inc., USA; Information Management Challenges in Achieving Coalition Interoperability; December 2001, pp. 3-1 - 3-4; In English; See also 20020016329; Copyright Waived; Avail: CASI; A01, Hardcopy; A03, Microfiche

When a software system fails, a confusing and complex liability problem ensues for all parties that have contributed software functionality (whether COTS (commercial off-the-shelf) or custom) to the system. Potential contributors to the system failure include: (1) defective software components, (2) problems with interfaces between components, (3) problems with assumptions (contractual requirements) between components, and (4) hidden interfaces and non-functional component behaviors that cannot be detected at the component level. In this paper, our goal is to focus on the interoperability problems created by defective COTS software components, and in particular, hidden interfaces and non-functional component behaviors. And we will also briefly look into the problem of how to compose one particular type of non-functional behavior, the 'ilities'.
Author
Commercial Off-The-Shelf Products; Computer Programs; Interoperability; System Failures; Computer Systems Design

20020016333 SPOTI, Issy- les- Moulineaux, France
FORMAL APPROACH OF THE INTEROPERABILITY OF C4IRS OPERATING WITHIN A COALITION *[APPROCHE FORMELLE DE L'INTEROPERABILITE DE SYSTEMES ENTRANT DANS UNE COALITION]*
Bares, Michel, SPOTI, France; Information Management Challenges in Achieving Coalition Interoperability; December 2001, pp. 4-1 - 4-13; In English; See also 20020016329; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

Coalitions between nations are formed to face either a crisis or emerging minor conflicts. These coalitions are formed for the purpose of increasing efficiency, by the coordinated action of military means and the gathering of their related technical systems, for instance: networks, C4IRS (Command and Control, Communications, Computers, Intelligence, Reconnaissance, and Surveillance). In merging these systems, we have to cope with a major problem, which is to have heterogeneous systems intercooperate. The verb intercooperate is intentionally used to highlight the new needs differing completely from the simple exchange messages. The heterogeneity of these systems, inherent to national design and applications concepts, generates big deficiencies at the interoperability level. Since the solution of making gangways is not easily and reasonably generalized, the right thing to do is to provide all systems entering in a coalition with interoperability mechanisms. In this paper, we propose a formal approach which is relying on three main concepts: openness structure for a coalition, interoperability space with the definition of an interoperability matrix, intercooperability domain in which we are able to define parameters that allow us to assess interoperability from different points of view.
Author
Interoperability; International Cooperation; Information Systems; Computer Systems Design; Information Transfer

20020016334 Defence Research Establishment Valcartier, Val Belair, Quebec Canada
UML MODELING RULES FOR INTEROPERABLE ARCHITECTURE ARTIFACTS
Lizotte, Michel, Defence Research Establishment Valcartier, Canada; Information Management Challenges in Achieving Coalition Interoperability; December 2001, pp. 6-1 - 6-14; In English; See also 20020016329; Original contains color illustrations; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

In recent years, time required to develop software interoperability solutions has become a key factor in the success of coalition operations. This paper introduces a set of Modeling Rules refining and restricting the Unified Modeling Language (UML) usage to a minimal set of models. Such an approach reduces precious time of software architects to get the right information and to understand the real issues of the problem. It enables navigation into software models from high-level artifacts down to the required level of detail using an object and behavior perspective.
Author
Interoperability; International Cooperation; Computer Programming; Software Development Tools

20020016335 Forschungsgesellschaft fuer Angewandte Naturwissenschaften e.V, Research Inst. for Communication, Information and Ergonomics, Wachtberg-Werthhoven, Germany
MODELLING COMMAND AND CONTROL INFORMATION SYSTEMS BY UML
Fassbender, Heinz, Forschungsgesellschaft fuer Angewandte Naturwissenschaften e.V, Germany; Buehler, Gerhard, Forschungsgesellschaft fuer Angewandte Naturwissenschaften e.V, Germany; Information Management Challenges in Achieving Coalition Interoperability; December 2001, pp. 7-1 - 7-9; In English; See also 20020016329; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

The complexity of command and control information systems is increasing continuously. The result of the augmentation of their interoperability to systems of own troops or foreign nations raises the difficulty for administration and maintenance. A possible approach to manage this problem is the use of a visual modelling annotation. It helps to manage the complex structures of command and control information systems. In the context of information modelling, the data model which is represented as an entity relationship diagram, has become a standard. This is a first step of the abstraction from the source code. But to give a complete survey, the design of the complete system has to be modelled. In former times when the structured style of programming was used, the architectures of programs were modelled by structured design techniques. In the last decade structured programming has been more and more replaced by object oriented programming. This leads to the definition of many object oriented analysis and design methods which are unified in the unified modelling language (UML). UML now is the standard for modelling object oriented information systems. In particular, UML offers an annotation for modelling interfaces. Hence, it seems to be the most promising candidate for modelling command and control information systems which should be interoperable. In this paper we illustrate how we model the existing experimental integration platform for command and control information systems. INFIS which has been developed in our institute and which serves as the German testbed for interoperability tests in the ATCCIS study and the Multilateral Interoperability Programme (MIP), by UML. That means, this paper will not include a description of modeling the different phases in the development of a new command and control information system. It describes how to model an existing command and control information system. The paper is structured as follows. In Section 2, the global structure of INFIS is modeled by a self-defined annotation and the usage of UML will be motivated. We present our UML modeling process for INFIS in Section 3. This process determines the structure of the following sections. Modeling INFIS high-level structure, its low-level structure, and their combination will be described in Sections 4, 5, and 6, respectively. We finish the UML-modelling process of INFIS by presenting a dynamic model that illustrates the interactions between INFIS objects for computing an application.
Author
Interoperability; Information Systems; Dynamic Models; Command And Control; International Cooperation; Programming Languages; Computer Systems Design

20020016336 Forschungsgesellschaft fuer Angewandte Naturwissenschaften e.V, FKIE, Wachtberg-Werthhoven, Germany
NATURAL LANGUAGE ACCESS FOR C4I SYSTEMS
Hecking, Matthias, Forschungsgesellschaft fuer Angewandte Naturwissenschaften e.V, Germany; Information Management Challenges in Achieving Coalition Interoperability; December 2001, pp. 8-1 - 8-8; In English; See also 20020016329; Original contains color illustrations; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

There is no precise meaning of the term 'interoperability'. In the proceedings of the conference Multi-Lingual Interoperability in Speech Technology, the term is further specified. Interoperability includes aspects between systems, between people, between people and systems, and for different tasks. In this paper we deal with the aspect of interoperability between people and systems. The basic message is that the use of human language can improve the cooperation between people and systems. But there is another aspect of using human language in human-computer interaction. New military NATO (North Atlantic Treaty Organization) operations and growing coalitions demand for more complex C4I (Command, Control, Communications, Computers and Intelligence) systems. The development cycles of these systems are becoming shorter. This also means, that the users will have less time to learn how to use these systems. A natural way to communicate is to use natural language. If the C4I systems would have the ability to process spoken language, this would reduce the training curve for new systems and would simplify the usage of the systems. Today, the usability of human language technology (HLT) is restricted to narrow and well defined application areas (domains). Another requirement is that the language must be restricted as well. This means, that the vocabulary and the grammatical structures must be limited enough such that processing time becomes acceptable. The military domain and the stereotyped military command language seem to be appropriated for using HLT. In our project NATLAC (natural language access) we try to show that the available methods, techniques, and tools of computational linguistics are mature enough to look whether they are applicable to C4I systems for different purposes. Especially, the scientific progress in the field of speech recognition is promising. In this paper, we will present the project NATLAC in more detail in section four and we will report about our experiences gained in the use of the speech recognizer. Prior in section two we give a short overview of the available information concerning military use of HLT and we mention those projects that use human language in C4I related areas. In section three possible applications of HLT in C4I systems are described.
Author
Command And Control; Computers; Human-Computer Interface; Interoperability; Natural Language (Computers)

20020016337 Defence Research Establishment Valcartier, Decision Support Technology Section, Val Belair, Quebec Canada
ONTOLOGIES FOR COALITION INTEROPERABILITY
Boury-Brisset, Anne-Claire, Defence Research Establishment Valcartier, Canada; Information Management Challenges in Achieving Coalition Interoperability; December 2001, pp. 9-1 - 9-10; In English; See also 20020016329; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

Future command and control information systems will have to take into account interoperability issues so that information can be effectively shared and exploited within coalition operations. In this context, interactions between participants require mechanisms to facilitate the exchange of information and provide a shared understanding of the situation based at least on a commonly agreed terminology. One solution to facilitate the communication between agents is to build a common ontology that represents a shared model of a domain. In this paper, we show the role of ontologies in coalition environments, we present methods and tools for collaborative ontology construction and describe how ontologies can facilitate interoperability between heterogeneous information sources.
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Command And Control; Information Systems; Interoperability

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DATA MANAGEMENT FOR COALITION INTEROPERABILITY
Kuees, Bernhard, Competence Center Informatik G.mb.H., Germany; Information Management Challenges in Achieving Coali-

tion Interoperability; December 2001, pp. 10-1 - 10-6; In English; See also 20020016329; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

Internationally agreed standard data definitions are crucial for coalition interoperability between C4I (Command, Control, Communication, Computers, and Intelligence) systems. A new standard data model for NATO (North Atlantic Treaty Organization) consultation, command, and control (C3) is the NATO Corporate Data Model. It comprises a collection of various data models including one generic reference data model used as its joint conceptual core. The NATO Corporate Data Model and all related administrative information are available in the NATO C3 Repository, a data dictionary and administration tool to support data management within NATO. In addition to this data dictionary support, a hierarchical structure with organizational interfaces between national and international data management authorities will be necessary in order to achieve a well-performing data management in the multinational community of NATO.

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Interoperability; Command And Control; Computers; Intelligence; Telecommunication; Data Management

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AN AGENT-BASED APPROACH TO ACHIEVE INTEROPERABLE AND ADAPTABLE MILITARY COALITIONS

Maamar, Zakaria, Zayed Univ., United Arab Emirates; Sahli, Nabil, Laval Univ., Canada; Moulin, Bernard, Laval Univ., Canada; Labbe, Paul, Defence Research Establishment Valcartier, Canada; Demers, David, Defence Research Establishment Valcartier, Canada; Information Management Challenges in Achieving Coalition Interoperability; December 2001, pp. 11-1 - 11-10; In English; See also 20020016329; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

Military coalitions not only exploit complex information technologies but also must be able to adapt to changing international and departmental agreements, operational procedures, and new technology insertion. A software agent is an autonomous entity that is able to carry out complex operations on behalf of users. In addition, a mobile agent is able to move from machine to machine, performing its operations locally. This paper discusses how software agents could be used to aid the interoperability and adaptability of military coalitions. Defining, managing, and adapting these coalitions' processes by way of agents is also discussed.

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Computer Programs; Interoperability; International Cooperation; Armed Forces

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KEY CONCEPTS FOR INFORMATION SUPERIORITY

Alberts, David S., Assistant Secretary of Defense (Research and Strategic Planning), USA; Information Management Challenges in Achieving Coalition Interoperability; December 2001, pp. 18-1 - 18-23; In English; See also 20020016329; Original contains color illustrations; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

Information Superiority is on the critical path of our journey to the future. This paper explains why this is so and identifies a number of specific actions that are necessary to facilitate our journey and to expedite progress toward our goal.

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DATA-TRANSLATION: LEVERAGING LEGACY DATA FOR NATO

Krick, Martin R., North Atlantic Treaty Organization, Netherlands; Information Management Challenges in Achieving Coalition Interoperability; December 2001, pp. 22-1 - 22-5; In English; See also 20020016329; Original contains color illustrations; Copyright Waived; Avail: CASI; A01, Hardcopy; A03, Microfiche

This paper describes an ongoing effort at NC3A (NATO (North Atlantic Treaty Organization) Command, Control, and Communication Agency) to provide one integrated database which contains data from a number of different sources. Initially, these sources are legacy NATO systems. Later, other systems, including messaging interfaces of a wide variety, and national systems, will be added. A common data model is used as the lingua franca between systems. A COTS (commercial off the shelf) product has been identified that creates translator boxes to provide interfaces to and from the legacy systems.

Author

Data Bases; North Atlantic Treaty Organization (NATO); Data Base Management Systems; Translating; Data Transfer (Computers); Interoperability

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DATA FUSION AND THE COALITION COMMON OPERATING PICTURE

Stewart, James, Ministry of Defence, UK; Pierre, Leslie, Ballistic Missile Defense Organization, USA; James, Paul, Defence Scientific Technology Lab., UK; Collinson, Alan, Collinson Systems Ltd., UK; Shand, Brian, Advanced System Architectures Ltd., UK; Information Management Challenges in Achieving Coalition Interoperability; December 2001, pp. 24-1 - 24-7; In English; See also 20020016329; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

BMDO (Ballistic Missile Defense Organization) and the UK (UK) Defense Evaluation and Research Agency (DERA) under the direction of the MOD (Ministry of Defense) DSc (Directorate of Science) (BMD) have undertaken a series of technical demonstrations to investigate data fusion applied to development of an operational picture. BMDO and MoD DSc(BMD) are concerned with the development of ballistic missile technology. However, ballistic missiles are only part of the threat in theater. The aim must be to integrate BMD into theater defense and use the common infrastructure. Hence, despite the focus on BMD, the work described has been undertaken in both ballistic targets and air breathing threat environments. Some further work is already being planned to be carried out later this year at Joint Exercise Roving Sands. This presentation describes the scope of the work undertaken and presents some of the most interesting results.

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Multisensor Fusion; Military Operations; Ballistic Missiles; International Cooperation

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INFORMATION INTEROPERABILITY AND INFORMATION STANDARDISATION FOR NATO C2: A PRACTICAL APPROACH

Lasschuyt, Eddie, Physics and Electronics Lab. TNO, Netherlands; vanHekken, Marcel, Physics and Electronics Lab. TNO, Netherlands; Information Management Challenges in Achieving Coalition Interoperability; December 2001, pp. 5-1 - 5-20; In English; See also 20020016329; Original contains color illustrations; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

This article discusses a general and practical approach to reach interoperability among a large number of information systems of different natures. It is focused on the subject of information standardization, for the purpose of gaining interoperable systems. Based upon this approach, a number of considerations and recommendations are given for interoperability within the NATO (North Atlantic Treaty Organization) C2 (Command and Control) domain, i.e. between NATO C4I (Command, Control, Communications, Computers, and Intelligence) systems. The article is primarily intended to give an overview of this problem area and to make the reader aware of its significance and difficulty. It could make him/her realize that information standards deserve more attention in his/her community (e.g. a policy division, Defense research lab or C4I-related working group) and it may trigger him/her to give more thoughts on the matter. We must emphasize, though, that some issues in this article are not (yet) fully crystallized or haven't proven their value in practice (yet). Further discussion on these issues in international forums is strongly suggested. In chapter 2 we start with a general introduction to interoperability, hereby setting the technical scope for this article. Chapter 3 defines the problem we want to solve. It does so in terms of possible interoperability architectures and factors that influence the choice. The theory of chapter 3 is applied in practice, on the NATO C2 domain, in chapter 4. Suggestions are given for improving the NATO standardization efforts. Finally, chapter 5 summarizes the conclusions made in the other chapters domain, i.e. between NATO

C4I systems. The article is primarily intended to give an overview of this problem area and to make the reader aware of its significance and difficulty.
Author
Command And Control; Information Systems; Interoperability; Standardization; International Cooperation

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ECONOMICS AND COST ANALYSIS

19990026332 Analytical Processes/Engineered Solutions, Inc., Saint Louis, MO USA
CORROSION IS A STRUCTURAL AND ECONOMIC PROBLEM: TRANSFORMING METRICS TO A LIFE PREDICTION METHOD
Brooks, Craig L., Analytical Processes/Engineered Solutions, Inc., USA; Prost-Domasky, Scott, Analytical Processes/Engineered Solutions, Inc., USA; Honeycutt, Kyle, Analytical Processes/Engineered Solutions, Inc., USA; Fatigue in the Presence of Corrosion; March 1999; 12p; In English; See also 19990026320; Sponsored in part by NCI, Inc.
Contract(s)/Grant(s): NCI-USAF-9061-007; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

This paper advocates a basic engineering approach to compute the effects of corrosion on structural capability. The analyses use fracture mechanics methods and fundamental engineering principles. Engineering computations are combined with damage tolerance assessment concepts to formulate a model to approximate the life degradation effects of corrosion. The methods and assumptions used in the analyses are based on reasonable physical characteristics. Where scientific data is unknown, rational judgements are made and several options are explored to bracket the results in terms of the assumptions. Sensitivities of the parameters are examined to establish overall relevance of results. Although the life predictions are calculated using deterministic techniques, the scope of the problem and thus the life impacts computed should be considered as probabilistic. The results of this approach provide the analyst with numerical impacts of potential scenarios and a means for quantifying the effects of corrosion with fatigue. The results also provide a 'benchmark' for methodology improvements as new data and information are obtained. Crack growth life analyses of particular geometry configurations are used to show the relative life impact of corrosion metrics. For example, typical surface morphologies generated by corrosion in a lap joint are evaluated. The local stress amplification due to the corrosion roughness reduced the regional crack growth capability of a surface crack by 70%. The impact of sustained stress build-up caused by corrosion-induced pillowing in a lap joint degraded structural life 25 to 35% for a crack adjacent to a fastener hole. These results represent the level of potential life degradation that could be realized in the corroded regions. The individual models isolate the contribution of effects attributed to corrosion (i.e., pillowing, surface morphologies, etc.) and analysis results emphasize the need to include corrosion parameters in a component service life assessment. A simulation of a pressurized fuselage skin splice is used to illustrate the analytically derived impact to the life and safety of the joint in the presence of corrosion. The analysis includes time-dependent effects of corrosion into the structural life prediction for a multi-site damage (MSD) scenario. Twenty and fifty year corrosion assumptions are used based upon conditions found in existing aircraft. The results of this analysis indicate that corrosion is a potential structural problem for the particular aircraft locations that are experiencing this type of corrosion attack. This paper presents the methodology for computing the effects of real time 'age degradation' on an aircraft structure. So it provides a means of using the existing Structural Integrity process to meet the needs, opportunities and challenges being presented by the aging aircraft fleet.
Author
Fatigue (Materials); Corrosion; Structural Failure; Aircraft Structures; Crack Propagation; Fracture Mechanics; Degradation; Surface Cracks; Aircraft Maintenance

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AN INTEGRATED APPROACH TO REDUCED TOTAL OWNERSHIP COSTS OF AIRCRAFT (RTOC)
Selegan, David R., Air Force Research Lab., USA; Moorhouse, David J., Air Force Research Lab., USA; LaManna, William J., Boeing Co., USA; Strategies to Mitigate Obsolescence in Defense Systems Using Commercial Components; June 2001, pp. 29-1 - 29-11; In English; See also 20010082326; Copyright Waived; Avail: CASI; A03, Hardcopy

The Reduced Total Cost of Ownership (RTOC) Study was a unique, 'out-of-the-box', integrated Science and Technology (New Processes and Techniques) approach to obtaining more affordable aircraft weapon systems and modernizing these systems for future combat scenarios. The RTOC Study stands in contrast to the individual 'bits and pieces' technology transition plans seen in the past. Individual plans can result in costly programs that are hard to justify and are easily attacked when evaluating fiscal parameters. An integrated Reduced Total Ownership Cost (RTOC) approach, with substantiation data provided by the proposed follow-on effort, would be easily justified by these same fiscal parameters using this new cost database.
Author
Cost Reduction; Data Bases

Subject Term Index

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