



National Aeronautics and  
Space Administration  
Langley Research Center  
Scientific and Technical  
Information Program Office

## Scientific and Technical Aerospace Reports

# STAR

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# NASA STI Program ... in Profile

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For more information about the NASA STI Program, you can:

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- Telephone the NASA STI Help Desk at (301) 621-0390
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NASA STI Help Desk  
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7121 Standard Drive  
Hanover, MD 21076-1320

# Introduction

*Scientific and Technical Aerospace Reports (STAR)* is an online information resource listing citations and abstracts of NASA and world wide aerospace-related STI. Updated biweekly, *STAR* highlights the most recent additions to the NASA STI Database. Through this resource, the NASA STI Program provides timely access to the most current aerospace-related Research & Development (R&D) results.

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- NASA, NASA contractor, and NASA grantee reports
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The STI Program offers products and tools that allow efficient access to the wealth of information derived from global R&D efforts. In addition, customized services are available to help tailor this valuable resource to meet your specific needs.

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# NASA STI Availability Information

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## National Technical Information Service (NTIS)

The National Technical Information Service serves the American public as a central resource for unlimited, unclassified U.S. Government scientific, technical, engineering, and business related information. For more than 50 years NTIS has provided businesses, universities, and the public timely access to well over 2 million publications covering over 350 subject areas. Visit NTIS at <http://www.ntis.gov>.

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The U.S. Patent and Trademark Office provides online access to full text patents and patent applications. The database includes patents back to 1976 plus some pre-1975 patents. Visit the USPTO at <http://www.uspto.gov/patft/>.

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## **Indexes**

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**Subject Term Index**

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# SCIENTIFIC AND TECHNICAL AEROSPACE REPORTS

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VOLUME 41, MARCH 21, 2003

## 02 AERODYNAMICS

*Includes aerodynamics of flight vehicles, test bodies, airframe components and combinations, wings, and control surfaces. Also includes aerodynamics of rotors, stators, fans and other elements of turbomachinery. For related information, see also 34 Fluid Mechanics and Heat Transfer.*

**20030014707** NASA Langley Research Center, Hampton, VA USA

### **An Overview of the RTO Symposium on Vortex Flow and High Angle of Attack Aerodynamics**

Luckring, James M., NASA Langley Research Center, USA; ICAS 2002 Congress; [2002], pp. 0229.1 - 0229.14; In English; 23rd International Congress of Aeronautical Sciences, 8-13 Sep. 2002, Toronto, Canada; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

In May of 2001 the Research and Technology Organization (RTO) sponsored a symposium on Vortex Flow and High Angle of Attack aerodynamics. Forty-six papers, organized into nine sessions, addressed computational and experimental studies of vortex flows pertinent to both aircraft and maritime applications. The studies also ranged from fundamental fluids investigations to flight test results. Selected highlights are included in this paper to provide a perspective toward the scope of the full symposium.

Author

*Angle of Attack; Conferences; General Overviews; Vortices; Computational Fluid Dynamics; Aerodynamic Characteristics; Research and Development*

**20030014748** Boeing Phantom Works, Long Beach, CA USA

### **Prediction of Drag Reduction in Supersonic and Hypersonic Flows with Counterflow Jets**

Daso, Endwell O., Boeing Phantom Works, USA; Beaulieu, Warren, Boeing Phantom Works, USA; Hager, James O., Boeing Phantom Works, USA; [2002]; 12p; In English; AIAA/AAAF 11th International Space Planes and Hypersonic Systems and Technologies Conference, 29 Sep. - 4 Oct. 2002, Orleans, France; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Report No.(s): AIAA Paper 2002-5115; Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche; Distribution as joint owner in the copyright; Distribution as joint owner in the copyright

Computational fluid dynamics solutions of the flowfield of a truncated cone-cylinder with and without counterflow jets have been obtained for the short penetration mode (SPM) and long penetration mode (LPM) of the freestream-counterflow jet interaction flowfield. For the case without the counterflow jet, the comparison of the normalized surface pressures showed very good agreement with experimental data. For the case with the SPM jet, the predicted surface pressures did not compare as well with the experimental data upstream of the expansion corner, while aft of the expansion corner, the comparison of the solution and the data is seen to give much better agreement. The difference in the prediction and the data could be due to the transient character of the jet penetration modes, possible effects of the plasma physics that are not accounted for here, or even the less likely effect of flow turbulence, etc. For the LPM jet computations, one-dimensional isentropic relations were used to derived the jet exit conditions in order to obtain the LPM solutions. The solution for the jet exit Mach number of 3 shows a jet penetration several times longer than that of the SPM, and therefore much weaker bow shock, with an attendant reduction in wave drag. The LPM jet is, in essence, seen to be a "pencil" of fluid, with much higher dynamic pressure, embedded in the oncoming supersonic or hypersonic freestream. The methodology for determining the conditions for the LPM jet could enable a practical approach for the design and application of counterflow LPM jets for the reduction of wave drag and heat flux, thus significantly enhancing the aerodynamic characteristics and aerothermal performance of supersonic and hypersonic vehicles. The solutions show that the qualitative flow structure is very well captured. The obtained results, therefore, suggest that counterflowing jets are viable

candidate technology concepts that can be employed to give significant reductions in wave drag, heat flux, and other attendant aerodynamic benefits.

Author

*Computational Fluid Dynamics; Hypersonic Flow; Counterflow; Jet Flow; Drag Reduction; Supersonic Flow; Computational Grids; Flow Distribution*

**20030014801** NASA Langley Research Center, Hampton, VA USA

**Low Dimensional Tools for Flow-Structure Interaction Problems: Application to Micro Air Vehicles**

Schmit, Ryan F., Clarkson Univ., USA; Glauser, Mark N., Syracuse Univ., USA; Gorton, Susan A., NASA Langley Research Center, USA; [2003]; 9p; In English; 41st AIAA Aerospace Science Meeting and Exhibit, 4-9 Jan. 2003, Reno, NV, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA; Original contains color illustrations

Report No.(s): AIAA Paper 2003-0626; Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche; Distribution as joint owner in the copyright; Distribution as joint owner in the copyright

A low dimensional tool for flow-structure interaction problems based on Proper Orthogonal Decomposition (POD) and modified Linear Stochastic Estimation (mLSE) has been proposed and was applied to a Micro Air Vehicle (MAV) wing. The method utilizes the dynamic strain measurements from the wing to estimate the POD expansion coefficients from which an estimation of the velocity in the wake can be obtained. For this experiment the MAV wing was set at five different angles of attack, from 0 deg to 20 deg. The tunnel velocities varied from 44 to 58 ft/sec with corresponding Reynolds numbers of 46,000 to 70,000. A stereo Particle Image Velocimetry (PIV) system was used to measure the wake of the MAV wing simultaneously with the signals from the twelve dynamic strain gauges mounted on the wing. With 20 out of 2400 POD modes, a reasonable estimation of the flow field was observed. By increasing the number of POD modes, a better estimation of the flow field will occur. Utilizing the simultaneously sampled strain gauges and flow field measurements in conjunction with mLSE, an estimation of the flow field with lower energy modes is reasonable. With these results, the methodology for estimating the wake flow field from just dynamic strain gauges is validated.

Author

*Wind Tunnel Tests; Flow Distribution; Strain Measurement; Airfoils; Mathematical Models; Computational Fluid Dynamics; Pilotless Aircraft*

**20030015399** NASA Langley Research Center, Hampton, VA USA

**Influence of Small Steps on Wall Pressure Fluctuation Spectra Measured on TU-144LL Flying Laboratory**

Efimtsov, B. M., Tsentralni Aerogidrodinamicheskii Inst., USSR; Golubev, A. Yu., Tsentralni Aerogidrodinamicheskii Inst., USSR; Rizzu, S. A., NASA Langley Research Center, USA; Andersson, A. O., Boeing Co., USA; Rackl, R. G., Boeing Co., USA; Andrianov, E. V., Tupolev, Russia; [2002]; 9p; In English; 8th AIAA/CEAS Aeroacoustics Conference, 17-19 Jun. 2002, Breckenridge, CO, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA; Original contains color illustrations

Report No.(s): AIAA Paper 2002-2605; Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche; Distribution as joint owner in the copyright; Distribution as joint owner in the copyright

Results of analyzing flight-test data of pressure-fluctuation fields in front of forward-facing steps and behind backward-facing steps are presented. The range of dimensionless step heights (normalized by boundary-layer displacement thickness) in the flight test was 0.042-0.236. The flight tests covered a mach-number range from 0.57 to 1.97. In the mach-number ranges covered by wind-tunnel tests (0.57 to 0.78 and 1.5 to 2) data agree very well with the flight data. Very importantly, the flight-test data fill in the gap previously existing for small-step pressure-fluctuations in the range of mach 0.78 to 1.5. Increased pressure-fluctuations were observed in the transonic region.

Author

*Flight Tests; Data Acquisition; Data Processing; Backward Facing Steps; Boundary Layers; Forward Facing Steps; Pressure Oscillations*

**20030015485** NASA Langley Research Center, Hampton, VA USA

**Accomplishments of the Abrupt Wing Stall (AWS) Program and Future Research Requirements**

Hall, Robert M., NASA Langley Research Center, USA; Woodson, Shawn H., Naval Air Systems Command, USA; Chambers, Joseph R., Ball Aerospace Systems Div., USA; [2003]; 21p; In English; 41st Aerospace Sciences Meeting and Exhibit, 6-9 Jan. 2003, Reno, NV, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA; Original contains color illustrations

Report No.(s): AIAA Paper 2003-0927; Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche; Distribution as joint owner in the copyright; Distribution as joint owner in the copyright

The Abrupt Wing Stall (AWS) Program has addressed the problem of uncommanded lateral motions, such as wing drop and wing rock, at transonic speeds. The genesis of this Program was the experience of the F/A-1 8E/F Program in the late 1990's, when wing drop was discovered in the heart of the maneuver envelope for the pre-production aircraft. While the F/A-1 8E/F problem was subsequently corrected by a leading-edge flap scheduling change and the addition of a porous door to the wing fold fairing, the AWS Program was initiated as a national response to the lack of technology readiness available at the time of the F/A-18E/F Development Program. The AWS Program objectives were to define causal factors for the F/A-18E/F experience, to gain insights into the flow physics associated with wing drop, and to develop methods and analytical tools so that future programs could identify this type of problem before going to flight test. The paper reviews, for the major goals of the AWS Program, the status of the technology before the

Author

*Wing Rock; Transonic Speed; Technology Assessment; Flight Tests; Aerodynamic Stalling*

**20030015758** NASA Langley Research Center, Hampton, VA USA

**Wake Closure Characteristics and Afterbody Heating on a Mars Sample Return Orbiter**

Horvath, Thomas J., NASA Langley Research Center, USA; Cheatwood, McNeil F., NASA Langley Research Center, USA; Wilmoth, Richard G., NASA Langley Research Center, USA; Alter, Stephen J., NASA Langley Research Center, USA; [2002]; 19p; In English; Space Technology and Applications International Forum, 3-7 Feb. 2002, Albuquerque, NM, USA; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Aeroheating wind-tunnel tests were conducted on a 0.028 scale model of an orbiter concept considered for a possible Mars sample return mission. The primary experimental objectives were to characterize hypersonic near wake closure and determine if shear layer impingement would occur on the proposed orbiter afterbody at incidence angles necessary for a Martian aerocapture maneuver. Global heat transfer mappings, surface streamline patterns, and shock shapes were obtained in the NASA Langley 20-Inch Mach 6 Air and CF4 Tunnels for post-normal shock Reynolds numbers (based on forebody diameter) ranging from 1,400 to 415,000, angles of attack ranging from -5 to 10 degrees at 0, 3, and 6 degree sideslip, and normal-shock density ratios of 5 and 12. Laminar, transitional, and turbulent shear layer impingement on the cylindrical afterbody was inferred from the measurements and resulted in a localized heating maximum that ranged from 40 to 75 percent of the reference forebody stagnation point heating. Comparison of laminar heating prediction to experimental measurement along the orbiter afterbody highlight grid alignment challenges associated with numerical simulation of three-dimensional separated wake flows. Predicted values of a continuum breakdown parameter revealed significant regions of non-continuum flow downstream of the flow separation at the MSRO shoulder and in the region of the reattachment shock on the afterbody. The presence of these regions suggest that the Navier-Stokes predictions at the laminar wind-tunnel condition may encounter errors in the numerical calculation of the wake shear layer development and impingement due to non-continuum effects.

Author

*Mars Sample Return Missions; Aerodynamic Heating; Wind Tunnel Tests; Hypersonic Wakes; Impingement; Aerocapture; Interplanetary Spacecraft; Flow Characteristics*

**20030015789** Naval Postgraduate School, Monterey, CA USA

**Department of Aeronautics and Astronautics**

Jan. 2000; 68p; In English

Report No.(s): AD-A409380; NPS-09-02-002; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This report contains project summaries of the research projects in the Department of Aeronautics and Astronautics. A list of recent publications is also included, which consists of conference presentations and publications, books, contributions to books, published journal papers, and technical reports. Thesis abstracts of students advised by faculty in the Department are also included. DTIC

*Armed Forces (USA); Documents*

**20030015865** NASA Langley Research Center, Hampton, VA USA

**Aerodynamic Measurement Technology**

Burner, Alpheus W., NASA Langley Research Center, USA; Aerospace America; December 2002, pp. 17; In English; Original contains color illustrations; No Copyright; Avail: Issuing Activity; Abstract Only

Ohio State University developed a new spectrally filtered light-scattering apparatus based on a diode laser injected-locked titanium: sapphire laser and rubidium vapor filter at 780.2 nm. When the device was combined with a stimulated Brillouin scattering phase conjugate mirror, the realizable peak attenuation of elastic scattering interferences exceeded 105. The potential of the system was demonstrated by performing Thomson scattering measurements. Under USAF-NASA funding, West Virginia

University developed a Doppler global velocimetry system using inexpensive 8-bit charged coupled device cameras and digitizers and a CW argon ion laser. It has demonstrated a precision of +/- 2.5 m/sec in a swirling jet flow. Low-noise silicon-micromachined microphones developed and incorporated in a novel two-tier, hybrid packaging scheme at the University of Florida used printed circuit board technology to realize a MEMS-based directional acoustic array. The array demonstrated excellent performance relative to conventional sensor technologies and provides scaling technologies that can reduce cost and increase speed and mobility.

Author

*Aerodynamics; Research and Development; Semiconductor Devices; Microphones; Microelectromechanical Systems; Integrated Circuits; Measuring Instruments*

**20030016511** NASA Langley Research Center, Hampton, VA USA

**CFD Variability for a Civil Transport Aircraft Near Buffet-Onset Conditions**

Rumsey, Christopher L., NASA Langley Research Center, USA; Morrison, Joseph H., NASA Langley Research Center, USA; Biedron, Robert T., NASA Langley Research Center, USA; February 2003; 25p; In English

Contract(s)/Grant(s): RTOP 719-10-40-10

Report No.(s): NASA/TM-2003-212149; NAS 1.15:212149; L-18256; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A CFD sensitivity analysis is conducted for an aircraft at several conditions, including flow with substantial separation (buffet onset). The sensitivity is studied using two different Navier-Stokes computer codes, three different turbulence models, and two different grid treatments of the wing trailing edge. This effort is a follow-on to an earlier study of CFD variation over a different aircraft in buffet onset conditions. Similar to the earlier study, the turbulence model is found to have the largest effect, with a variation of 3.8% in lift at the buffet onset angle of attack. Drag and moment variation are 2.9% and 23.6%, respectively. The variations due to code and trailing edge cap grid are smaller than that due to turbulence model. Overall, the combined approximate error band in CFD due to code, turbulence model, and trailing edge treatment at the buffet onset angle of attack are: 4% in lift, 3% in drag, and 31% in moment. The CFD results show similar trends to flight test data, but also exhibit a lift curve break not seen in the data.

Author

*Computational Fluid Dynamics; Buffeting; Transport Aircraft; Sensitivity Analysis; Trailing Edges; Wings*

**20030017746** NASA Langley Research Center, Hampton, VA USA

**Aerodynamic Design Opportunities for Future Supersonic Aircraft**

Wood, Richard M., NASA Langley Research Center, USA; Bauer, Steven X. S., NASA Langley Research Center, USA; Flamm, Jeffrey D., NASA Langley Research Center, USA; [2002]; 40p; In English; 23rd International Congress of Aeronautical Sciences, 8-13 Sep. 2002, Toronto, Canada; Original contains color illustrations

Report No.(s): ICAS-2002-8.7.1(I.L.); Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche; Distribution under U.S. Government purpose rights; Distribution under U.S. Government purpose rights

A discussion of a diverse set of aerodynamic opportunities to improve the aerodynamic performance of future supersonic aircraft has been presented and discussed. These ideas are offered to the community in a hope that future supersonic vehicle development activities will not be hindered by past efforts. A number of nonlinear flow based drag reduction technologies are presented and discussed. The subject technologies are related to the areas of interference flows, vehicle concepts, vortex flows, wing design, advanced control effectors, and planform design. The authors also discussed the importance of improving the aerodynamic design environment to allow creativity and knowledge greater influence. A review of all of the data presented show that pressure drag reductions on the order of 50 to 60 counts are achievable, compared to a conventional supersonic cruise vehicle, with the application of several of the discussed technologies. These drag reductions would correlate to a 30 to 40% increase in cruise L/D (lift-to-drag ratio) for a commercial supersonic transport.

Author

*Supersonic Aircraft; Aircraft Design; Aerodynamic Characteristics; Drag Reduction; Nonlinearity*

**20030017770** NASA Langley Research Center, Hampton, VA USA

**Virtual Shaping of a Two-dimensional NACA 0015 Airfoil Using Synthetic Jet Actuator**

Chen, Fang-Jenq, NASA Langley Research Center, USA; Beeler, George B., NASA Langley Research Center, USA; 2002; 11p; In English; 1st AIAA Flow Control Conference, 24-26 Jun. 2002, Saint Louis, MI, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA; Original contains color illustrations

Report No.(s): AIAA Paper 2002-3273; Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche; Distribution under U.S. Government purpose rights; Distribution under U.S. Government purpose rights

The Aircraft Morphing Program at NASA Langley envisions an aircraft without conventional control surfaces. Instead of moving control surfaces, the vehicle control systems may be implemented with a combination of propulsive forces, micro surface effectors, and fluidic devices dynamically operated by an intelligent flight control system to provide aircraft maneuverability over each mission segment. As a part of this program, a two-dimensional NACA 0015 airfoil model was designed to test mild maneuvering capability of synthetic jets in a subsonic wind tunnel. The objective of the experiments is to assess the applicability of using unsteady suction and blowing to alter the aerodynamic shape of an airfoil with a purpose to enhance lift and/or to reduce drag. Synthetic jet actuation at different chordwise locations, different forcing frequencies and amplitudes, under different freestream velocities are investigated. The effect of virtual shape change is indicated by a localized increase of surface pressure in the neighborhood of synthetic jet actuation. That causes a negative lift to the airfoil with an upper surface actuation. When actuation is applied near the airfoil leading edge, it appears that the stagnation line is shifted inducing an effect similar to that caused by a small angle of attack to produce an overall lift change.

Author

*Airfoils; Actuators; Aerodynamic Configurations; Maneuverability; Wind Tunnel Tests*

**20030017831** Georgia Inst. of Tech., Dept. of Aerospace Engineering, Atlanta, GA USA

**Application of a Symmetric Total Variation Diminishing Scheme to Aerodynamics of Rotors *Final Report***

Sankar, Lakshmi N., Georgia Inst. of Tech., USA; August 2002; 216p; In English; Original contains color illustrations; No Copyright; Avail: CASI; A10, Hardcopy; A03, Microfiche

The aerodynamics characteristics of rotors in hover have been studied on stretched non-orthogonal grids using spatially high order symmetric total variation diminishing (STVD) schemes. Several companion numerical viscosity terms have been tested. The effects of higher order metrics, higher order load integrations and turbulence effects on the rotor performance have been studied. Where possible, calculations for 1-D and 2-D benchmark problems have been done on uniform grids, and comparisons with exact solutions have been made to understand the dispersion and dissipation characteristics of these algorithms. A baseline finite volume methodology termed TURNS (Transonic Unsteady Rotor Navier-Stokes) is the starting point for this effort. The original TURNS solver solves the 3-D compressible Navier-Stokes equations in an integral form using a third order upwind scheme. It is first or second order accurate in time. In the modified solver, the inviscid flux at a cell face is decomposed into two parts. The first part of the flux is symmetric in space, while the second part consists of an upwind-biased numerical viscosity term. The symmetric part of the flux at the cell face is computed to fourth-, sixth- or eighth order accuracy in space. The numerical viscosity portion of the flux is computed using either a third order accurate MUSCL scheme or a fifth order WENO scheme. A number of results are presented for the two-bladed Caradonna-Tung rotor and for a four-bladed UH-60A rotor in hover. Comparisons with the original TURNS code, and experiments are given. Results are also presented on the effects of metrics calculations, load integration algorithms, and turbulence models on the solution accuracy. A total of 64 combinations were studied in this thesis work. For brevity, only a small subset of results highlighting the most important conclusions are presented. It should be noted that use of higher order formulations did not affect the temporal stability of the algorithm and did not require any reduction in the time step. The calculations show that the solution accuracy increases when the 3rd order upwind scheme in the baseline algorithm is replaced with 4th and 6th order accurate symmetric flux calculations. A point of diminishing returns is reached as increasingly larger stencils are used on highly stretched grids. The numerical viscosity term, when computed with the third order MUSCL scheme, is very dissipative, and does not resolve the tip vortex well. The WENO5 scheme, on the other hand significantly improves the tip vortex capturing. The STVD6+WENO5 scheme, in particular gave the best combinations of solution accuracy and efficiency on stretched grids. Spatially fourth order accurate metric calculations were found to be beneficial, but should be used in conjunction with a limiter that drops the metric calculation to a second order accuracy in the vicinity of grid discontinuities. High order integration of loads was found to have a beneficial, but small effect on the computed loads. Replacing the Baldwin-Lomax turbulence model with a one equation Spalart-Allmaras model resulted in higher than expected profile power contributions. Nevertheless the one-equation model is recommended for its robustness, its ability to model separated flows at high thrust settings, and the natural manner in which turbulence in the rotor wake may be treated.

Author

*Rotor Aerodynamics; Hovering; Robustness (Mathematics); Measure and Integration; Mathematical Models*

**20030018104** NASA Ames Research Center, Moffett Field, CA USA

**Aerodynamic Shape Optimization using an Evolutionary Algorithm**

Holst, Terry L., NASA Ames Research Center, USA; Pulliam, Thomas H., NASA Ames Research Center, USA; Jan. 21, 2003; 33p; In English, 3 Mar. 2003, Pasadena, CA, USA; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A method for aerodynamic shape optimization based on an evolutionary algorithm approach is presented and demonstrated. Results are presented for a number of model problems to assess the effect of algorithm parameters on convergence efficiency and

reliability. A transonic viscous airfoil optimization problem, both single and two-objective variations, is used as the basis for a preliminary comparison with an adjoint-gradient optimizer. The evolutionary algorithm is coupled with a transonic full potential flow solver and is used to optimize the inviscid flow about transonic wings including multi-objective and multi-discipline solutions that lead to the generation of pareto fronts. The results indicate that the evolutionary algorithm approach is easy to implement, flexible in application and extremely reliable.

Author

*Aerodynamic Configurations; Algorithms; Shape Optimization; Airfoils*

### 03

## AIR TRANSPORTATION AND SAFETY

*Includes passenger and cargo air transport operations; aircraft ground operations; flight safety and hazards; and aircraft accidents. Systems and hardware specific to ground operations of aircraft and to airport construction are covered in 09 Research and Support Facilities (Air). Air traffic control is covered in 04 Aircraft Communications and Navigation. For related information see also 16 Space Transportation and Safety; and 85 Technology Utilization and Surface Transportation.*

**20030014699** General Accounting Office, Washington, DC USA

**Commercial Aviation: Factors Affecting Efforts to Improve Air Service at Small Community Airports**

Jan. 2003; 94p

Report No.(s): PB2003-102502; GAO-03-330; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

The airline industry, facing unprecedented financial losses as a result of the economic downturn and the terrorist attacks, has taken steps to minimize losses, including reducing or eliminating service to some small communities. In March 2002, GAO reported that small communities had almost 20 percent fewer departures in October 2001, as compared to October 2000. GAO was asked to follow up on that work by examining the challenges small communities face in attracting and keeping the air service they desire and what steps they have taken to overcome these challenges.

NTIS

*Air Transportation; Civil Aviation; Airports; Congressional Reports*

**20030014793** Research Triangle Inst., Research Triangle Park, NC USA

**Characterizing the Severe Turbulence Environments Associated with Commercial Aviation Accidents, Part 2, Hydrostatic Mesobeta Scale Numerical Simulations of Supergradient Wind Flow and Streamwise Ageostrophic Frontogenesis**

Kaplan, Michael L., North Carolina State Univ., USA; Huffman, Allan W., North Carolina State Univ., USA; Lux, Kevin M., North Carolina State Univ., USA; Cetola, Jeffrey D., North Carolina State Univ., USA; Charney, Joseph J., Forest Service, USA; Riordan, Allen J., North Carolina State Univ., USA; Lin, Yuh-Lang, North Carolina State Univ., USA; Waight, Kenneth T., III, MESO, Inc., USA; February 2003; 45p; In English

Contract(s)/Grant(s): NAS1-99074; 82U-7473-008; RTOP 728-40-30-01

Report No.(s): NASA/CR-2003-212138; NAS 1.26:212138; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Simulation experiments reveal key processes that organize a hydrostatic environment conducive to severe turbulence. The paradigm requires juxtaposition of the entrance region of a curved jet stream, which is highly subgeostrophic, with the entrance region of a straight jet stream, which is highly supergeostrophic. The wind and mass fields become misphased as the entrance regions converge resulting in the significant spatial variation of inertial forcing, centripetal forcing, and along- and cross-stream pressure gradient forcing over a mesobeta scale region. This results in frontogenesis and the along-stream divergence of cyclonic and convergence of cyclonic ageostrophic vertical vorticity. The centripetally forced mesoscale front becomes the locus of large gradients of ageostrophic vertical vorticity along an overturning isentrope. This region becomes favorable for streamwise vorticity gradient formation enhancing the environment for organization of horizontal vortex tubes in the presence of buoyant forcing.

Author

*Simulation; Hydrostatics; Turbulence; Geostrophic Wind; Civil Aviation; Commercial Aircraft; Aircraft Accidents*

**20030014827** Federal Aviation Administration, Office of Aviation Research, Washington, DC USA

**Issues Concerning the Structural Coverage of Object-Oriented Software *Final Report***

Nov. 2002; 44p

Report No.(s): PB2003-102070; DOT/FAA/AR-02/113; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report provides information to international certification authorities to assist with the development of policy and guidance for the use of object-oriented technology (OOT) to develop software for commercial airborne computer-based systems. The research focuses on the aspects of structural coverage that are impacted by the use of OOT.

NTIS

*Civil Aviation; Object-Oriented Programming; Commercial Aircraft*

**20030015428** Army Safety Center, Fort Rucker, AL USA

**FLIGHTFAX: Army Aviation Risk-Management Information. Volume 30, Number 11**

Nov. 2002; 20p; In English; Original contains color images

Report No.(s): AD-A409434; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

No abstract.

DTIC

*Risk; Aeronautics; Military Helicopters; Information Management*

**20030015785** Naval Air Warfare Center, Aircraft Div., Patuxent River, MD USA

**Testing Conducted on Wall-Hanging Troop Seats**

Testerman, Rachael; Sep. 12, 2002; 57p; In English; Original contains color images

Report No.(s): AD-A409374; NAWCADPAX/TR-2002/94; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This report presents the data collected during testing conducted at NAWCAD Patuxent River, Maryland. The tests conducted were static load tests and were conducted on wall-hanging troop seats. Four seats were tested, all of them being of the three-man configuration. Tests were conducted for the Defense Logistics Agency and the Air Force. All photographs and data collected from the testing are contained herein.

DTIC

*Static Loads; Static Tests; Seats*

**20030015792** Civil Aeromedical Inst., Civil Aeromedical Inst., Oklahoma City, OK USA

**General Aviation Maintenance-Related Accidents: A Review of Ten Years of NTSB Data Final Report**

Goldman, Scott M.; Fiedler, Edna R.; King, Raymond E.; Dec. 2002; 12p; In English

Report No.(s): AD-A409385; DOT/FAA/AM-02/23; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

NTSB accident investigation reports for general aviation accidents occurring between 1988 and 1997 were analyzed in order to provide a descriptive look at ten years worth of accident data. This sample included 1,503 reports, all of which indicated at least one maintenance-related issue as a cause or factor in the accident. Initial analyses describe the frequency of occurrence for type of maintenance task and type of aircraft. Accidents were compared on frequency of occurrence, number of fatalities, and number of serious injuries. Odds for each variable resulting in a fatality or injury are reported. Results indicated that installation errors were the leading maintenance-related cause or factor involved with the accidents. Since installation errors were most common further analyses focused on a more detailed description of installation error. Type of installation error, type of aircraft system involved in the installation, whether or not the installation was inspected, credentials of the mechanic performing the installation, and the operational impact of the installation error were investigated. Results indicate that reversed installation and wrong part were the two installation errors most likely to cause death or injury in GA aircraft accident.

DTIC

*Aircraft Accidents; Accident Investigation; Errors*

**20030016714** General Accounting Office, Washington, DC USA

**Aviation Security: Vulnerabilities and Potential Improvements for the Air Cargo System**

Dec. 2002; 36p; In English

Report No.(s): PB2003-102436; GAO-03-344; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

U.S. air carriers transport billions of tons of cargo each year in both passenger planes and all-cargo planes. Keeping that cargo secure is the responsibility of the Department of Transportation (DOT) Transportation Security Administration (TSA), which was created in November 2001 by the Aviation and Transportation Security Act. Prior to that date, the Federal Aviation Administration (FAA) had this responsibility. To ensure air cargo security, the act requires the screening of all cargo carried aboard commercial passenger aircraft and requires TSA to have a system in place as soon as practicable to screen or otherwise ensure the security of cargo on all-cargo aircraft. You asked us to examine the security of air cargo.

NTIS

*Air Cargo; Passenger Aircraft; Aircraft Safety; Cargo Aircraft; Air Transportation*

**20030017749** Federal Aviation Administration, Associate Administrator for Airports, Washington, DC USA

**Injuries and Fatalities of Workers Struck by Vehicles on Airport Aprons**

Jul. 2002; In English; This document is color dependent and/or in landscape layout. It is currently only available on CD-ROM Report No.(s): PB2003-102001; No Copyright; Avail: National Technical Information Service (NTIS)

Section 520 of the Wendell H. Ford Aviation Investment and Reform Act for the 21st Century (AIR-21) required the Federal Aviation Administration (FAA) to conduct the study described below and report the results to Congress by April 5, 2001: The Administrator shall conduct a study to determine the number of persons working at airports who are injured or killed as a result of being struck by a moving vehicle while on an airport tarmac, the seriousness of the injuries to such persons, and whether or not reflective safety vests or other actions should be required to enhance the safety of such workers. The report identifies possible remedial occupational safety actions that might prevent or reduce the number or severity of struck by injuries and evaluates safety vests or high visibility clothing only in terms of their general effectiveness.

NTIS

*Airports; Injuries; Clothing; Safety; Personnel*

**20030017764** National Transportation Safety Board, Washington, DC USA

**National Transportation Safety Board Aircraft Accident Report: In-Flight Electrical System Failure and Loss of Control, Jet Express Services, Raytheon (Beechcraft) Super King Air 200,N81PF, Near Strasburg, Colorado, on January 27, 2001**

Jan. 15, 2003; 60p; In English

Report No.(s): PB2003-910401; NTSB/AAR-03/01; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

On January 27, 2001, about 1737 mountain standard time, a Raytheon (Beechcraft) Super King Air 200, N81PF, owned by North Bay Charter, LLC, and operated by Jet Express Services, crashed into rolling terrain near Strasburg, Colorado. The National Transportation Safety Board determines that the probable cause of this accident was the pilots spatial disorientation resulting from his failure to maintain positive manual control of the airplane with the available flight instrumentation. Contributing to the cause of the accident was the loss of a.c. electrical power during instrument meteorological conditions. The safety issue discussed in this report is the lack of oversight for athletic team and other college- and university-sponsored travel.

NTIS

*Aircraft Accidents; Accident Investigation; Safety Management*

## 04

### AIRCRAFT COMMUNICATIONS AND NAVIGATION

*Includes all modes of communication with and between aircraft; air navigation systems (satellite and ground based); and air traffic control. For related information see also 06 Avionics and Aircraft Instrumentation; 17 Space Communications; Spacecraft Communications, Command and Tracking, and 32 Communications and Radar.*

**20030014737** Science Applications International Corp., Moffett Field, CA USA

**Getting your Ticket Changed: Negotiations, Dilemmas and Social Compensation When Travel Breaks Down at the Airport**

Wales, Roxana, Science Applications International Corp., USA; Mirmalek, Zara, California Univ., USA; Nov. 23, 2002; 9p; In English; American Anthropological Association Meeting, 23 Nov. 2002, New Orleans, LA, USA

Contract(s)/Grant(s): NAS2-00065; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

This paper presents viewgraphs on supported and unsupported negotiation interactions between customer service representatives and customers when travel disruptions occur in airports.

CASI

*Airports; Sociology; Airline Operations; Human Relations*

**20030014807** NASA Langley Research Center, Hampton, VA USA

**NASA Langley and NLR Research of Distributed Air/Ground Traffic Management**

Ballin, Mark G., NASA Langley Research Center, USA; Hoekstra, Jacco M., National Aerospace Lab., Netherlands; Wing, David J., NASA Langley Research Center, USA; Lohr, Gary W., NASA Langley Research Center, USA; [2002]; 13p; In English; AIAA's Aircraft Technology, Integration and Operations 2002 Technical Forum, 1-3 Oct. 2002, Los Angeles, CA, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA; Original contains color illustrations

Report No.(s): AIAA Paper 2002-5826; Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche; Distribution as joint owner in the copyright; Distribution as joint owner in the copyright

Distributed Air/Ground Traffic Management (DAG-TM) is a concept of future air traffic operations that proposes to distribute information, decision-making authority, and responsibility among flight crews, the air traffic service provider, and aeronautical operational control organizations. This paper provides an overview and status of DAG-TM research at NASA Langley Research Center and the National Aerospace Laboratory of The Netherlands. Specific objectives of the research are to evaluate the technical and operational feasibility of the autonomous airborne component of DAG-TM, which is founded on the operational paradigm of free flight. The paper includes an overview of research approaches, the airborne technologies under development, and a summary of experimental investigations and findings to date. Although research is not yet complete, these findings indicate that free flight is feasible and will significantly enhance system capacity and safety. While free flight cannot alone resolve the complex issues faced by those modernizing the global airspace, it should be considered an essential part of a comprehensive air traffic management modernization activity.

Author

*Air Traffic Control; Autonomy; Free Flight; Airline Operations; Flight Simulation; General Overviews; Ground Based Control*

**20030015402** NASA Langley Research Center, Hampton, VA USA

**A Flight Deck Decision Support Tool for Autonomous Airborne Operations**

Ballin, Mark G., NASA Langley Research Center, USA; Sharma, Vivek, Titan Systems, Inc., USA; Vivona, Robert A., Titan Systems, Inc., USA; Johnson, Edward J., NASA Langley Research Center, USA; Ramiscal, Ermin, NASA Langley Research Center, USA; [2002]; 11p; In English; AIAA Guidance, Navigation and Control Conference, 5-8 Aug. 2002, Monterey, CA, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA; Original contains color illustrations; Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche; Distribution as joint owner in the copyright; Distribution as joint owner in the copyright

NASA is developing a flight deck decision support tool to support research into autonomous operations in a future distributed air/ground traffic management environment. This interactive real-time decision aid, referred to as the Autonomous Operations Planner (AOP), will enable the flight crew to plan autonomously in the presence of dense traffic and complex flight management constraints. In assisting the flight crew, the AOP accounts for traffic flow management and airspace constraints, schedule requirements, weather hazards, aircraft operational limits, and crew or airline flight-planning goals. This paper describes the AOP and presents an overview of functional and implementation design considerations required for its development. Required AOP functionality is described, its application in autonomous operations research is discussed, and a prototype software architecture for the AOP is presented.

Author

*Autonomy; Decision Support Systems; Flight Operations; Flight Plans*

**20030015749** Massachusetts Inst. of Tech., Feron, Eric, Cambridge, MA USA

**Distributed and Centralized Conflict Management Under Traffic Flow Management Constraints *Final Report***

Feron, Eric, Massachusetts Inst. of Tech., USA; Feb. 05, 2003; 112p; In English

Contract(s)/Grant(s): NCC2-1209; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

Current air transportation in the USA relies on a system born half a century ago. While demand for air travel has kept increasing over the years, technologies at the heart of the National Airspace System (NAS) have not been able to follow an adequate evolution. For instance, computers used to centralize flight data in airspace sectors run a software developed in 1972. Safety, as well as certification and portability issues arise as major obstacles for the improvement of the system. The NAS is a structure that has never been designed, but has rather evolved over time. This has many drawbacks, mainly due to a lack of integration and engineering leading to many inefficiencies and losses of performance. To improve the operations, understanding of this complex needs to be built up to a certain level. This work presents research done on Air Traffic Management (ATM) at the level of the en-route sector.

Derived from text

*Air Traffic Control; Mathematical Models; Air Transportation; Flight Management Systems; Flight Characteristics; Air Navigation*

**20030015751** NASA Glenn Research Center, Cleveland, OH USA

**Airborne Satcom Terminal Research at NASA Glenn**

Hoder, Doug, NASA Glenn Research Center, USA; Zakrajsek, Robert, NASA Glenn Research Center, USA; December 2002; 34p; In English; Original contains color illustrations

Contract(s)/Grant(s): RTOP 727-01-04

Report No.(s): NASA/TM-2002-212006; E-13693; NAS 1.15:212006; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

NASA Glenn has constructed an airborne Ku-band satellite terminal, which provides wideband full-duplex ground-aircraft communications. The terminal makes use of novel electronically-steered phased array antennas and provides IP connectivity to and from the ground. The satcom terminal communications equipment may be easily changed whenever a new configuration is required, enhancing the terminal's versatility.

Author

*Broadband; Superhigh Frequencies; Communication Satellites; Airborne Equipment; Research and Development; Aircraft Antennas; Terminals*

**20030017827** NASA Langley Research Center, Hampton, VA USA

**A Multi-Operator Simulation for Investigation of Distributed Air Traffic Management Concepts**

Peters, Mark E., NASA Langley Research Center, USA; Ballin, Mark G., NASA Langley Research Center, USA; Sakosky, John S., NASA Langley Research Center, USA; [2002]; 14p; In English; AIAA Guidance, Navigation and Control Conference, 5-8 Aug. 2002, Monterey, CA, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA; Original contains color illustrations; Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche; Distribution as joint owner in the copyright; Distribution as joint owner in the copyright

This paper discusses the current development of an air traffic operations simulation that supports feasibility research for advanced air traffic management concepts. The Air Traffic Operations Simulation (ATOS) supports the research of future concepts that provide a much greater role for the flight crew in traffic management decision-making. ATOS provides representations of the future communications, navigation, and surveillance (CNS) infrastructure, a future flight deck systems architecture, and advanced crew interfaces. ATOS also provides a platform for the development of advanced flight guidance and decision support systems that may be required for autonomous operations.

Author

*Air Traffic Control; Architecture (Computers); Autonomy; Flight Simulation; Avionics; Flight Operations*

## 05

### AIRCRAFT DESIGN, TESTING AND PERFORMANCE

*Includes all stages of design of aircraft and aircraft structures and systems. Also includes aircraft testing, performance, and evaluation, and aircraft and flight simulation technology. For related information, see also 18 Spacecraft Design, Testing and Performance and 39 Structural Mechanics. For land transportation vehicles, see 85 Technology Utilization and Surface Transportation.*

**20030014796** Raytheon Technical Services Co., Indianapolis, IN USA

**Aircraft Age-Related Degradation Study on Single and Three-Phase Circuit Breakers Final Report, Jul. 01 - Dec. 01**

Peterson, R. G.; Kurek, J.; Nov. 2002; 224p

Report No.(s): PB2003-102027; No Copyright; Avail: CASI; A10, Hardcopy; A03, Microfiche

The purpose of the test program is to provide data needed to determine to what extent circuit breakers removed from aging aircraft have degraded from their original performance specification parameters. The data will be used to help the Federal Aviation Administration (FAA) to determine causes of breaker degradation, to determine to what extent degradation may affect the continued safe operation of the wiring component protected by the breaker, and to determine the impact of the degradation on aircraft performance.

NTIS

*Circuit Breakers; Aging (Materials); Aircraft Equipment; Aircraft Performance; Functional Design Specifications*

**20030015429** FROM, Flight Dynamics Directorate

**Test Report on Vibration Measurements on the C-141 Laser Test Final Report, 1 Aug. 1976-26 Sep. 1978**

Banaszak, David L.; Brown, Dansen; Aug. 1979; 78p; In English

Contract(s)/Grant(s): Proj-431G

Report No.(s): AD-A409425; AFFDL-TM-79-9; AFFDL/FBG/79-9; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

This test report presents data which define the vibration environment of a chemical laser system on a C-141 aircraft. These data were needed to determine if there are any severe vibration problems due to the abnormally large amount of weight added by the laser system to the C-141 petal door area.

DTIC

*C-141 Aircraft; Vibration Measurement; Chemical Lasers; Doors*

**20030015482** NASA Langley Research Center, Hampton, VA USA

**A Subjective Test of Modulated Blade Spacing for Helicopter Main Rotors**

Sullivan, Brenda M., NASA Langley Research Center, USA; Edwards, Bryan D., Textron Bell Helicopter, USA; Brentner, Kenneth S., Pennsylvania State Univ., USA; Booth, Earl R., Jr., NASA Langley Research Center, USA; [2002]; 8p; In English; American Helicopter Society 58th Annual Forum, 11-13 Jun. 2002, Montreal, Canada; Sponsored by American Helicopter Society, Inc., USA

Contract(s)/Grant(s): NAS1-00091; Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche; Distribution under U.S. Government purpose rights under contract number NAS1-00091; Distribution under U.S. Government purpose rights under contract number NAS1-00091

Analytically, uneven (modulated) spacing of main rotor blades was found to reduce helicopter noise. A study was performed to see if these reductions transferred to improvements in subjective response. Using a predictive computer code, sounds produced by six main rotor configurations: 4 blades evenly spaced, 5 blades evenly spaced and four configurations with 5 blades with modulated spacing of varying amounts, were predicted. These predictions were converted to audible sounds corresponding to the level flyover, takeoff and approach flight conditions. Subjects who heard the simulations were asked to assess the overflight sounds in terms of noisiness on a scale of 0 to 10. In general the evenly spaced configurations were found less noisy than the modulated spacings, possibly because the uneven spacings produced a perceptible pulsating sound due to the very low fundamental frequency.

Author

*Rotary Wings; Helicopters; Noise Prediction (Aircraft); Simulation; Aircraft Noise*

**20030015818** Raytheon Technical Services Co., Indianapolis, IN USA

**Aircraft Age-Related Degradation Study on Single- and Three-Phase Circuit Breakers Final Report, Jul.-Dec. 2001**

Peterson, Ronnie G.; Kurek, Joseph; Nov. 2002; 208p; In English

Contract(s)/Grant(s): DTFA-03-01-C-00018

Report No.(s): AD-A409465; DOT/FAA/AR-01/118; No Copyright; Avail: CASI; A10, Hardcopy; A03, Microfiche

This report provides technical data and brief observations generated for a controlled series of tests on circuit breakers removed from an aging Boeing 727-232 and a McDonnell Douglas DC-10 aircraft. The test program is divided into two groups (Process 1 and Process 2). Sixty circuit breakers in Process 1 were tested for 200% and 500% current overloads. Two hundred forty circuit breakers in Process 2 were tested for voltage drop at rated current, minimum and maximum limits of ultimate trip, 150% and 200% low current overload, and 400% to 500% high current overload. The low voltage contact resistance and temperature rise were continuously monitored. This report also contains a summary of results generated by the FAA Airworthiness Assurance Nondestructive Inspection Validation Center located at Sandia National Laboratories on circuit breakers removed from three aged aircraft. The results of the tests protocols indicated that circuit breakers installed in aircraft with extended service life will continue to protect the electrical wire provided the maintenance procedures recommended in the report are performed annually. The report also recommends proposed changes to SAE Aero-Space Standards to improve circuit protection on future aircraft. This report also contains technical data generated by the FAA Airworthiness Assurance Nondestructive Inspection Validation Center on circuit breakers removed from three retired aircraft. The most significant result of this study is a 39% failure rate in the 114% to 138% current overload ranges. The value and impact of this study still needs to be determined.

DTIC

*Commercial Aircraft; Circuit Breakers*

**20030017994** Toledo Univ., Dept. of Mechanical, Industrial and Manufacturing Engineering, OH USA

**Production of Near-Mirror Surface Quality by Precision Grinding**

Dimofte, Florin, Toledo Univ., USA; Krantz, Timothy, Army Research Lab., USA; [2003]; 4p; In English

Contract(s)/Grant(s): NAG3-2269; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Mechanical components such as gears and bearings operate with the working surfaces in intimate contact with a mating part. The performance of such components will be influenced by the quality of the working surface. In general, a smoother surface will perform better than a rougher surface since the lubrication conditions are improved. For example, surfaces with a special

near-mirror quality finish of low roughness performed better than ground surfaces when tested using a block-on-ring arrangement. Bearings with near-mirror quality have been tested and analyzed; lower running torques were measured and improved fatigue life was anticipated. Experiments have been done to evaluate the performance of gears with improved, low roughness surface finishing. The measured performance improvements include an increased scuffing (scoring) load capacity by a factor of 1.6, a 30-percent reduction of gear tooth running friction, and longer fatigue lives by a factor of about four. One can also anticipate that near-mirror quality surface finishing could improve the performance of other mechanical components such as mechanical seals and heavily loaded journal bearings. Given these demonstrated benefits, capable and economical methods for the production of mechanical components with near-mirror quality surfaces are desired. One could propose the production of near-mirror quality surfaces by several methods such as abrasive polishing, chemical assisted polishing, or grinding. Production of the surfaces by grinding offers the possibility to control the macro-geometry (form), waviness, and surface texture with one process. The present study was carried out to investigate the possibility of producing near-mirror quality surfaces by grinding. The present study makes use of a specially designed grinding machine spindle to improve the surface quality relative to the quality produced when using a spindle of conventional design.

Derived from text

*Grinding Machines; Surface Geometry; Micromachining; Mechanical Drives; Metal Surfaces; Mechanical Engineering*

**20030017995** Computer Sciences Corp., USA

**Website on Protein Interaction and Protein Structure Related Work**

Samanta, Manoj, Computer Sciences Corp., USA; Liang, Shoudan, NASA Ames Research Center, USA; Jan. 07, 2003; 52p; In English

Contract(s)/Grant(s): NAS2-14303; RTOP 519-40-12; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

In today's world, three seemingly diverse fields - computer information technology, nanotechnology and biotechnology are joining forces to enlarge our scientific knowledge and solve complex technological problems. Our group is dedicated to conduct theoretical research exploring the challenges in this area. The major areas of research include: 1) Yeast Protein Interactions; 2) Protein Structures; and 3) Current Transport through Small Molecules.

Derived from text

*Biotechnology; Nanotechnology; Proteins; Websites*

**20030018099** National Academy of Sciences - National Research Council, Eglin AFB, FL USA

**Uniblade Air Rotor and Flight and Covercraft Vehicles with Its**

Bolonkin, Alexander A., Inventor, National Academy of Sciences - National Research Council, USA; May 22, 2001; 1p; In English

Patent Info.: Filed 1 Dec. 1998; US-Patent-6,234,422; US-Patent-Appl-SN-203130; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The invention is related to air flight vehicles, such as vertical take-off and landing (VTOL) airplanes, helicopters and covercraft. The goal of this invention is to create an air rotor designed so that while after vertical take off or cover regime, one can be stopped, fixed in a specific position and hidden into the fuselage (gondola) thus eliminating of air resistance when the rotor is not in working state. On landing this rotor can be extended out, brought into rotation and used for creation of lift force and vertical landing. The indicated goal is achieved by means of the rotor made as single blade (uniblade). The author solved the problem of force and moment balance of single blade. The center of gravity of the counterweight is located below the horizontal plane, and the blade has the horizontal sway axle, that crosses the vertical rotor rotation axis. The author offer this rotor on single axis, on co-axis, and on different exiles. This uniblade rotor is designed to subsonic and supersonic VTOL airplanes, for helicopter cars, fight motorcycles, hoppycopters, and covercraft. The uniblades be used also as a veritable sweep wing (for subsonic and supersonic aircraft).

Official Gazette of the U.S. Patent and Trademark Office

*Aerospace Vehicles; Vertical Landing; Vertical Takeoff Aircraft; Rotor Blades (Turbomachinery); Aerodynamic Characteristics*

## 06

### AVIONICS AND AIRCRAFT INSTRUMENTATION

*Includes all stages of design of aircraft and aircraft structures and systems. Also includes aircraft testing, performance, and evaluation, and aircraft and flight simulation technology. For related information, see also 18 Spacecraft Design, Testing and Performance and 39 Structural Mechanics. For land transportation vehicles, see 85 Technology Utilization and Surface Transportation.*

**20030015806** Old Dominion Univ., Norfolk, VA USA

**A Product Development Decision Model for Cockpit Weather Information System *Final Report***

Sireli, Yesim, Old Dominion Univ., USA; Kauffmann, Paul, Old Dominion Univ., USA; Gupta, Surabhi, Virginia Polytechnic Inst. and State Univ., USA; Kachroo, Pushkin, Virginia Polytechnic Inst. and State Univ., USA; [2003]; 69p; In English

Contract(s)/Grant(s): NAG1-01097; ODURF Proj. 101652; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

There is a significant market demand for advanced cockpit weather information products. However, it is unclear how to identify the most promising technological options that provide the desired mix of consumer requirements by employing feasible technical systems at a price that achieves market success. This study develops a unique product development decision model that employs Quality Function Deployment (QFD) and Kano's model of consumer choice. This model is specifically designed for exploration and resolution of this and similar information technology related product development problems.

Author

*Cockpit Weather Information Systems; Meteorological Services; Product Development*

## 07

### AIRCRAFT PROPULSION AND POWER

*Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and onboard auxiliary power plants for aircraft. For related information see also 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels, and 44 Energy Production and Conversion.*

**20030014738** California Univ., Berkeley, CA USA

**Characterization of Liquid Fuel Evaporation of a Lifted Methanol Spray Flame in a Vitiated Coflow Burner *Final Report***

Cabra, Ricardo, California Univ., USA; Dibble, Robert W., California Univ., USA; Chen, Jyh-Yuan, California Univ., USA; December 2002; 21p; In English; Original contains color illustrations

Contract(s)/Grant(s): NAG3-2103; RTOP 708-90-01

Report No.(s): NASA/CR-2002-212083; NAS 1.26:212083; E-13736; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

An experimental investigation of lifted spray flames in a coflow of hot, vitiated gases is presented. The vitiated coflow burner is a spray flame that issues into a coaxial flow of hot combustion products from a lean, premixed H<sub>2</sub>/Air flame. The spray flame in a vitiated coflow emulates the combustion that occurs in many advanced combustors without the detailed fluid mechanics. Two commercially available laser diagnostic systems are used to characterize the spray flame and to demonstrate the vitiated coflow burner's amenability to optical investigation. The Ensemble Particle Concentration and Size (EPCS) system is used to measure the path-average droplet size distribution and liquid volume fraction at several axial locations while an extractive probe instrument named the Real-time Fuel-air Analyzer (RFA) is used to measure the air to fuel ratio downstream of the spray nozzle with high temporal and spatial resolution. The effect of coflow conditions (stoichiometry) and dilution of the fuel with water was studied with the EPCS optical system. As expected, results show that water retards the evaporation and combustion of fuels. Measurements obtained by the RFA extractive probe show that while the Delavan manufactured nozzle does distribute the fuel over the manufacturer specified spray angle, it unfortunately does not distribute the fuel uniformly, providing conditions that may result in the production of unwanted NO<sub>x</sub>. Despite some limitations due to the inherent nature of the experimental techniques, the two diagnostics can be readily applied to spray flames in the vitiated coflow environment.

Author

*Combustion; Evaporation; Flames; Liquid Fuels; Methyl Alcohol; Coaxial Flow*

**20030015690** Analex Corp., Brook Park, OH USA

**Convective Array Cooling for a Solar Powered Aircraft *Final Report***

Colozza, Anthony J., Analex Corp., USA; January 2003; 28p; In English; Original contains color illustrations

Contract(s)/Grant(s): NAS3-00145; RTOP 708-87-11

Report No.(s): NASA/CR-2003-212084; NAS 1.26:212084; E-13737; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A general characteristic of photovoltaics is that they increase in efficiency as their operating temperature decreases. Based on this principal, the ability to increase a solar aircraft's performance by cooling the solar cells was examined. The solar cells were cooled by channeling some air underneath the cells and providing a convective cooling path to the back side of the array. A full energy balance and flow analysis of the air within the cooling passage was performed. The analysis was first performed on a preliminary level to estimate the benefits of the cooling passage. This analysis established a clear benefit to the cooling passage. Based on these results a more detailed analysis was performed. From this cell temperatures were calculated and array output power throughout a day period were determined with and without the cooling passage. The results showed that if the flow through the cooling passage remained laminar then the benefit in increased output power more than offset the drag induced by the cooling passage.

Author

*Cooling; Solar Cells; Solar Powered Aircraft; Solar Arrays; Pilotless Aircraft; Convective Heat Transfer*

**20030016688** NASA Glenn Research Center, Cleveland, OH USA

**Film Cooling Flow Effects on Post-Combustor Trace Chemistry**

Wey, Thomas, Taitech, Inc., USA; Liu, Nan-Suey, NASA Glenn Research Center, USA; January 2003; 20p; In English; Original contains color illustrations

Contract(s)/Grant(s): RTOP 714-01-13

Report No.(s): NASA/TM-2003-212018; NAS 1.15:212018; E-13722; Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche; Distribution as joint owner in the copyright; Distribution as joint owner in the copyright

Film cooling injection is widely applied in the thermal design of turbomachinery, as it contributes to achieve higher operating temperature conditions of modern gas turbines, and to meet the requirements for reliability and life cycles. It is a significant part of the high-pressure turbine system. The film cooling injection, however, interacts with the main flow and is susceptible to have an influence on the aerodynamic performance of the cooled components, and through that may cause a penalty on the overall efficiency of the gas turbine. The main reasons are the loss of total pressure resulting from mixing the cooling air with mainstream and the reduction of the gas stagnation temperature at the exit of the combustion chamber to a lower value at the exit of nozzle guide vane. In addition, the impact of the injected air on the evolution of the trace species of the hot gas is not yet quite clear. This work computationally investigates the film cooling influence on post-combustor trace chemistry, as trace species in aircraft exhaust affect climate and ozone.

Author

*Film Cooling; Gas Turbines; Environment Effects; Liquid Injection; Exhaust Emission; Combustion Chemistry*

## 08

### AIRCRAFT STABILITY AND CONTROL

*Includes flight dynamics, aircraft handling qualities; piloting; flight controls; and autopilots. For related information, see also 05 Aircraft Design, Testing and Performance and 06 Avionics and Aircraft Instrumentation.*

**20030015486** NASA Langley Research Center, Hampton, VA USA

**Response Surface Methods for Spatially-Resolved Optical Measurement Techniques**

Danehy, P. M., NASA Langley Research Center, USA; Dorrington, A. A., National Academy of Sciences - National Research Council, USA; Cutler, A. D., George Washington Univ., USA; DeLoach, R., NASA Langley Research Center, USA; [2003]; 17p; In English; 41st Aerospace Sciences Meeting and Exhibit, 6-9 Jan. 2003, Reno, NV, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA; Original contains color illustrations

Report No.(s): AIAA Paper 2003-0648; Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche; Distribution as joint owner in the copyright; Distribution as joint owner in the copyright

Response surface methods (or methodology), RSM, have been applied to improve data quality for two vastly different spatially-resolved optical measurement techniques. In the first application, modern design of experiments (MDOE) methods, including RSM, are employed to map the temperature field in a direct-connect supersonic combustion test facility at NASA Langley Research Center. The laser-based measurement technique known as coherent anti-Stokes Raman spectroscopy (CARS) is used to measure temperature at various locations in the combustor. RSM is then used to develop temperature maps of the flow. Even though the temperature fluctuations at a single point in the flowfield have a standard deviation on the order of 300 K, RSM provides analytic fits to the data having 95% confidence interval half width uncertainties in the fit as low as +/-30 K. Methods of optimizing

future CARS experiments are explored. The second application of RSM is to quantify the shape of a 5-meter diameter, ultra-light, inflatable space antenna at NASA Langley Research Center.

Author

*Optical Measurement; Supersonic Combustion; Flow Distribution; Experiment Design; Combustion Chambers*

**20030015759** George Washington Univ., School of Engineering and Applied Science, Washington, DC USA  
**Program of Research in Flight Dynamics in the JIAFS, George Washington University at NASA Langley Research Center Annual Report, 1 Dec. - 30 Nov. 2002**

Klein, Vladislav, George Washington Univ., USA; [2002]; 6p; In English

Contract(s)/Grant(s): NCC1-326; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The program objectives are fully defined in the original proposal entitled 'Program of Research in Flight Dynamics in GW at NASA Langley Research Center,' which was originated March 20, 1975, and in the renewals of the research program from December 1, 2000 to November 30, 2001. The program in its present form includes three major topics: 1) the improvement of existing methods and development of new methods for wind tunnel and flight test data analysis, 2) the application of these methods to wind tunnel and flight test data obtained from advanced airplanes, 3) the correlation of flight results with wind tunnel measurements, and theoretical predictions. The Principal Investigator of the program is Dr. Vladislav Klein. Three Graduate Research Scholar Assistants (K. G. Mas, M. M. Eissa and N. M. Szyba) also participated in the program. Specific developments in the program during the period Dec. 1, 2001 through Nov. 30, 2002 included: 1) Data analysis of highly swept delta wing aircraft from wind and water tunnel data, and 2) Aerodynamic characteristics of the radio control aircraft from flight test.

Author

*Aerodynamic Characteristics; Flight Tests; Wind Tunnel Tests; Research; University Program*

## 09

### RESEARCH AND SUPPORT FACILITIES (AIR)

*Includes airports, runways, hangars, and aircraft repair and overhaul facilities; wind tunnels, water tunnels, and shock tubes; flight simulators; and aircraft engine test stands. Also includes airport ground equipment and systems. For airport ground operations see 03 Air Transportation and Safety. For astronomical facilities see 14 Ground Support Systems and Facilities (Space).*

**20030015727** NASA Langley Research Center, Hampton, VA USA

**Unified Instrumentation: Examining the Simultaneous Application of Advanced Measurement Techniques for Increased Wind Tunnel Testing Capability**

Fleming, Gary A., Editor, NASA Langley Research Center, USA; Bartram, Scott M., NASA Langley Research Center, USA; Humphreys, William M., Jr., NASA Langley Research Center, USA; Jenkins, Luther N., NASA Langley Research Center, USA; Jordan, Jeffrey D., NASA Langley Research Center, USA; Lee, Joseph W., NASA Langley Research Center, USA; Leighty, Bradley D., NASA Langley Research Center, USA; Meyers, James F., NASA Langley Research Center, USA; South, Bruce W., NASA Langley Research Center, USA; Cavone, Angelo A., Swales Aerospace, USA; Ingram, JoAnne L., Swales Aerospace, USA; [2002]; 35p; In English; 22nd AIAA Aerodynamic Measurement Technology and Ground Testing Conference, 24-26 Jun. 2002, Saint Louis, MO, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA; Original contains color illustrations

Report No.(s): AIAA Paper 2002-3244; Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche; Distribution as joint owner in the copyright; Distribution as joint owner in the copyright

A Unified Instrumentation Test examining the combined application of Pressure Sensitive Paint, Projection Moire Interferometry, Digital Particle Image Velocimetry, Doppler Global Velocimetry, and Acoustic Microphone Array has been conducted at the NASA Langley Research Center. The fundamental purposes of conducting the test were to: (a) identify and solve compatibility issues among the techniques that would inhibit their simultaneous application in a wind tunnel, and (b) demonstrate that simultaneous use of advanced instrumentation techniques is feasible for increasing tunnel efficiency and identifying control surface actuation / aerodynamic reaction phenomena. This paper provides summary descriptions of each measurement technique used during the Unified Instrumentation Test, their implementation for testing in a unified fashion, and example results identifying areas of instrument compatibility and incompatibility. Conclusions are drawn regarding the conditions under which the measurement techniques can be operated simultaneously on a non-interference basis. Finally, areas requiring improvement for successfully applying unified instrumentation in future wind tunnel tests are addressed.

Author

*Wind Tunnel Tests; Velocity Measurement; Moire Interferometry; Compatibility; Aerodynamic Characteristics*

**ASTRONAUTICS (GENERAL)**

*Includes general research topics related to space flight and manned and unmanned space vehicles, platforms or objects launched into, or assembled in, outer space; and related components and equipment. Also includes manufacturing and maintenance of such vehicles or platforms. For specific topics in astronautics see categories 13 through 20. For extraterrestrial exploration, see 91 Lunar and Planetary Science and Exploration.*

**20030014892** Army Aviation and Missile Command, Propulsion and Structures Directorate, Redstone Arsenal, AL USA

**Army Tactical Missile System (TACMS) Block II Insensitive Munitions Test Results**

Fisher, Jamie M., Army Aviation and Missile Command, USA; Nelson, Steven G., Army Aviation and Missile Command, USA; 20th JANNAF Propulsion Systems Hazards Subcommittee Meeting; April 2002; Volume 1, pp. 1-13; In English; Also announced as 20030014891; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC

The Army TACMS Block II missile system provides the soldier with long range precision fire against moving armored combat vehicles in support of deep operations beyond the capability of other currently existing munitions. As part of an ongoing IM program for the ATACMS/BAT, warhead components were subject to IM threats identified in the system's Threat Hazard Assessment. These tests were conducted to assess the reaction of the Block II warhead, containing BAT submunitions, to bullet impact, fragment impact and fast cook-off. This paper will provide a summary of the test item configurations, test setups, results and preliminary assessments.

Author

*Combat; Missile Systems; Hazards; Firing (Igniting)*

**20030015481** NASA Langley Research Center, Hampton, VA USA

**Orbital Aggregation and Space Infrastructure Systems (OASIS)**

Troutman, Patrick A., NASA Langley Research Center, USA; Mazanek, Daniel D., NASA Langley Research Center, USA; Stillwagen, Frederic H., NASA Langley Research Center, USA; Antol, Jeffrey, NASA Langley Research Center, USA; Sarver-Verhey, Timothy R., NASA Glenn Research Center, USA; Chato, David J., NASA Glenn Research Center, USA; Saucillo, Rudolf J., Boeing Phantom Works, USA; Blue, Douglas R., Boeing Phantom Works, USA; Carey, David, Boeing Phantom Works, USA; Krizan, Shawn A., Analytical Mechanics Associates, Inc., USA; [2002]; 14p; In English; 53rd International Astronautical Congress, 10-19 Oct. 2002, Houston, TX, Houston, TX, USA, USA; Sponsored by International Astronautical Federation, France; Original contains color illustrations

Report No.(s): IAC-02-IAA.13.2.06; Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche; Distribution as joint owner in the copyright; Distribution as joint owner in the copyright

This paper summarizes the results of a NASA lead study performed to identify synergistic opportunities and concepts between human exploration initiatives and commercialization of space. The goal of this initiative, called Orbital Aggregation & Space Infrastructure Systems (OASIS), is to develop an in-space architecture and associated concepts that provide common infrastructure for enabling a large class of space missions. The concepts include communications, navigation and power systems, propellant modules, tank farms, habitats, and in-space transportation systems using several propulsion technologies. OASIS features in-space aggregation of systems and resources in support of mission objectives. The concepts feature a high level of reusability and are supported by inexpensive launch of propellant and logistics payloads from the Earth/moon system. Industry, NASA and other users could share infrastructure costs. The anticipated benefits of synergistic utilization of space infrastructure are reduced mission costs and increased mission flexibility for future space exploration and commercialization initiatives.

Author

*Aerospace Systems; Logistics; Low Cost; Payloads; Propellant Tanks; Space Commercialization; Space Exploration; Telecommunication*

**LAUNCH VEHICLES AND LAUNCH OPERATIONS**

*Includes all classes of launch vehicles, launch/space vehicle systems, and boosters; and launch operations. For related information see also 18 Spacecraft Design, Testing, and Performance; and 20 Spacecraft Propulsion and Power.*

**20030014810** NASA Marshall Space Flight Center, Huntsville, AL USA

**Advanced Guidance and Control Methods for Reusable Launch Vehicles: Test Results**

Hanson, John M., NASA Marshall Space Flight Center, USA; Jones, Robert E., Sverdrup Technology, Inc., USA; Krupp, Don

R., NASA Marshall Space Flight Center, USA; [2002]; 14p; In English; AIAA Guidance, Navigation and Control Conference, 5-8 Aug. 2002, Monterey, CA, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA; Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche; Distribution as joint owner in the copyright; Distribution as joint owner in the copyright

There are a number of approaches to advanced guidance and control (AG&C) that have the potential for achieving the goals of significantly increasing reusable launch vehicle (RLV) safety/reliability and reducing the cost. In this paper, we examine some of these methods and compare the results. We briefly introduce the various methods under test, list the test cases used to demonstrate that the desired results are achieved, show an automated test scoring method that greatly reduces the evaluation effort required, and display results of the tests. Results are shown for the algorithms that have entered testing so far.

Author

*Reusable Launch Vehicles; Flight Control; Flight Tests; Entry Guidance (STS); Control Systems Design; Methodology*

**20030014832** NASA Langley Research Center, Hampton, VA USA

### **Structural Weight Estimation for Launch Vehicles**

Cerro, Jeff, NASA Langley Research Center, USA; Martinovic, Zoran, NASA Langley Research Center, USA; Su, Philip, Raytheon Technical Services Co., USA; Eldred, Lloyd, Swales Aerospace, USA; [2002]; 18p; In English; 61st International Conference on Mass Properties Engineering, 18-22 May 2002, Virginia Beach, VA, USA; Original contains color illustrations Report No.(s): SAWE Paper 3201; Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche; Distribution as joint owner in the copyright; Distribution as joint owner in the copyright

This paper describes some of the work in progress to develop automated structural weight estimation procedures within the Vehicle Analysis Branch (VAB) of the NASA Langley Research Center. One task of the VAB is to perform system studies at the conceptual and early preliminary design stages on launch vehicles and in-space transportation systems. Some examples of these studies for Earth to Orbit (ETO) systems are the Future Space Transportation System [1], Orbit On Demand Vehicle [2], Venture Star [3], and the Personnel Rescue Vehicle[4]. Structural weight calculation for launch vehicle studies can exist on several levels of fidelity. Typically historically based weight equations are used in a vehicle sizing program. Many of the studies in the vehicle analysis branch have been enhanced in terms of structural weight fraction prediction by utilizing some level of off-line structural analysis to incorporate material property, load intensity, and configuration effects which may not be captured by the historical weight equations. Modification of Mass Estimating Relationships (MER's) to assess design and technology impacts on vehicle performance are necessary to prioritize design and technology development decisions. Modern CAD/CAE software, ever increasing computational power and platform independent computer programming languages such as JAVA provide new means to create greater depth of analysis tools which can be included into the conceptual design phase of launch vehicle development. Commercial framework computing environments provide easy to program techniques which coordinate and implement the flow of data in a distributed heterogeneous computing environment. It is the intent of this paper to present a process in development at NASA LaRC for enhanced structural weight estimation using this state of the art computational power.

Derived from text

*Launch Vehicles; Structural Weight; Weight Analysis; Estimating; Space Transportation System*

**20030015735** Aerospace Corp., Space Systems Div., El Segundo, CA USA

### **Suborbital Reusable Launch Vehicles and Applicable Markets**

Martin, J. C.; Law, G. W.; Oct. 2002; 118p; In English

Report No.(s): PB2003-102442; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

The purpose of this report is to survey and characterize suborbital reusable launch vehicles (RLVs) in development, as well as to identify current and emerging suborbital market opportunities that these systems may enable. Over the past 30 years, NASA has accepted the burden of developing technologies that will enable cheaper access to orbital space, as evidenced by its past X-programs and the current Space Launch Initiative. Various private companies have also attempted, and are still attempting, to develop new RLV systems for orbital space applications. However, the large development costs of such systems, coupled with the downturn of the low Earth orbit market (e.g., Iridium, GlobalStar), have made private sector development of orbital RLV systems increasingly difficult at this time. Given these hurdles, many commercial space transportation companies have begun shifting focus toward suborbital market opportunities, for which the technical challenge is much lower and the cost of market entry less expensive.

NTIS

*Reusable Launch Vehicles; Low Earth Orbits; Spacecraft Launching; Space Commercialization*

**20030016601** NASA Glenn Research Center, Cleveland, OH USA

**Finite Element Simulation of a Space Shuttle Solid Rocket Booster Aft Skirt Splashdown Using an Arbitrary Lagrangian-Eulerian Approach**

Melis, Matthew E., NASA Glenn Research Center, USA; January 2003; 14p; In English; Original contains color illustrations

Contract(s)/Grant(s): RTOP 721-26-13

Report No.(s): NASA/TM-2003-212093; NAS 1.15:212093; E-13745; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Explicit finite element techniques employing an Arbitrary Lagrangian-Eulerian (ALE) methodology, within the transient dynamic code LS-DYNA, are used to predict splashdown loads on a proposed replacement/upgrade of the hydrazine tanks on the thrust vector control system housed within the aft skirt of a Space Shuttle Solid Rocket Booster. Two preliminary studies are performed prior to the full aft skirt analysis: An analysis of the proposed tank impacting water without supporting aft skirt structure, and an analysis of space capsule water drop tests conducted at NASA's Langley Research Center. Results from the preliminary studies provide confidence that useful predictions can be made by applying the ALE methodology to a detailed analysis of a 26-degree section of the skirt with proposed tank attached. Results for all three studies are presented and compared to limited experimental data. The challenges of using the LS-DYNA ALE capability for this type of analysis are discussed.

Author

*Finite Element Method; Space Shuttle Boosters; Skirts; Water Landing; Euler-Lagrange Equation*

**20030017987** National Academy of Sciences - National Research Council, Elgin AFB, USA

**Hypersonic Launch System of Capability Up 200 Tons Per Day and Delivery Cost \$1/lb**

Bolonkin, Alexander, National Academy of Sciences - National Research Council, USA; [2002]; 12p; In English; 53rd International Astronautical Congress, 10-19 Oct. 2002, Houston, TX, Houston, TX, USA, USA

Report No.(s): IAC-02-S.P.15; Copyright; Avail: Issuing Activity

The present contribution describes a hypersonic gas rocket, which uses tube walls as moving compressed air container. It suggests burn programs (fuel injections) which enable the use of the internal components as a rocket. Along tube (up to 1-3 km) provides mobility and serves to aim water. Relatively inexpensive oxidizer and fuel used (compressed air or gaseous oxygen and kerosene). When a projectile crosses the Earth's atmosphere with near vertical trajectory, loss of speed and the weight of required thermal protection system are small. The research shows that the launcher can give a projectile a speed of up 5-8 km/sec. The proposed launcher can deliver up to 85,000 tons of payload to space annually a cost of one to two dollars per pound of payload. The Launcher can also deliver about 500 tons of mail or express parcels per day over continental distances. During war, this launch system could deliver munitions to targets thousands to tens thousands of kilometers away from the launch site.

Author

*Hypersonic Flow; Launchers; Compressed Air; Fuel Injection; Projectiles*

**20030018097** National Academy of Sciences - National Research Council, Elgin AFB, USA

**Non-Rocket Space Rope Launcher for People**

Bolonkin, Alexander, National Academy of Sciences - National Research Council, USA; [2002]; 8p; In English; 53rd International Astronautical Congress, 10-19 Oct. 2002, Houston, TX, Houston, TX, USA, USA

Report No.(s): IAC-02-V.P.06; Copyright; Avail: Issuing Activity

The method and facilities for delivering payload and people into outer space are presented. This method uses, in general, the engines and straight or closed-loop cables disposed on a planet surface. The installation consists of a space apparatus, power drive stations located along trajectory of the apparatus, the cables connected to the apparatus and to the power stations, a system for suspending the cable, and disconnected device. The drive stations accelerate the apparatus up to hypersonic speed. The estimations and computations show the possibility of making these projects a reality in a short period of time (see attached project: launcher for tourists). The launch will be very cheap \$1-\$2 per LB. We need only light strong cable, which can be made from artificial fibers, whiskers, nanotubes, which exist in industry and scientific laboratories.

Author

*Rocket Launchers; Payloads; Hypersonic Speed; Feedback Control; Space Stations*

**20030018253** National Academy of Sciences - National Research Council, Eglin AFB, FL USA

**Non-Rocket Earth-Mars Transport System**

Bolonkin, Alexander, National Academy of Sciences - National Research Council, USA; [2002]; 12p; In English; 34th COSPAR Scientific Assembly, 10-19 Oct. 2002, Houston, TX, Houston, TX, USA, USA; Sponsored by Committee on Space Research, Unknown

Report No.(s): COSPAR-02-A-02226; BO.4-C3.4-0036-02; Copyright; Avail: Issuing Activity

The author offered and computed a new permanent cable transport system that connects a Pole of Earth and Mars orbit. This system allows the Connection of Earth and Mars during 1-1.5 months every 1.7-2 years when they are nearest to each other and to transport people and useful loads to Mars and back. The system has big advantages because it uses the transport engine located on Earth, but it also requests the high strength cable be constructed from nanotubes. This manuscript contains an equation of equal stress, which connects the Earth and Mars orbit. That contains also the computed parameters of the suggested system.

Author

*Earth-Moon System; Earth Orbits; Mars (Planet); Transport Theory; Payloads*

## 16

### SPACE TRANSPORTATION AND SAFETY

*Includes passenger and cargo space transportation, e.g., shuttle operations; and space rescue techniques. For related information, see also 03 Air Transportation and Safety and 15 Launch Vehicles and Launch Vehicles, and 18 Spacecraft Design, Testing and Performance. For space suits, see 54 Man/System Technology and Life Support.*

**20030014794** NASA Langley Research Center, Hampton, VA USA

#### **Multibody Parachute Flight Simulations for Planetary Entry Trajectories Using "Equilibrium Points"**

Raiszadeh, Ben, NASA Langley Research Center, USA; [2003]; 13p; In English; 13th AAS/AIAA Space Flight Mechanics Meeting, 9-13 Feb. 2003, Ponce, Puerto Rico; Sponsored by American Astronomical Society, USA; Original contains color illustrations

Report No.(s): AAS-03-163; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A method has been developed to reduce numerical stiffness and computer CPU requirements of high fidelity multibody flight simulations involving parachutes for planetary entry trajectories. Typical parachute entry configurations consist of entry bodies suspended from a parachute, connected by flexible lines. To accurately calculate line forces and moments, the simulations need to keep track of the point where the flexible lines meet (confluence point). In previous multibody parachute flight simulations, the confluence point has been modeled as a point mass. Using a point mass for the confluence point tends to make the simulation numerically stiff, because its mass is typically much less than the main rigid body masses. One solution for stiff differential equations is to use a very small integration time step. However, this results in large computer CPU requirements. In the method described in the paper, the need for using a mass as the confluence point has been eliminated. Instead, the confluence point is modeled using an "equilibrium point". This point is calculated at every integration step as the point at which sum of all line forces is zero (static equilibrium). The use of this "equilibrium point" has the advantage of both reducing the numerical stiffness of the simulations, and eliminating the dynamical equations associated with vibration of a lumped mass on a high-tension string.

Author

*Atmospheric Entry; Flight Simulation; Parachutes; Trajectories; Differential Equations; Computerized Simulation*

**20030014800** NASA Langley Research Center, Hampton, VA USA

#### **Autonomous Aerobraking at Mars**

Hanna, Jill L., NASA Langley Research Center, USA; Tolson, Robert, George Washington Univ., USA; Cianciolo, Alicia Dwyer, NASA Langley Research Center, USA; Dec, John, NASA Langley Research Center, USA; [2002]; 8p; In English; 5th International Conference on Spacecraft Guidance, Navigation and Control Systems, 22-25 Oct. 2002, Frascati, Italy; Original contains color illustrations; Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche; Distribution as joint owner in the copyright; Distribution as joint owner in the copyright

Aerobraking has become a proven approach for orbital missions at Mars. A launch of a 1000 kg class spacecraft on a Delta class booster saves 90% of the post-MOI fuel otherwise required to circularize the orbit. In 1997, Mars Global Surveyor demonstrated the feasibility and Mars 2001 Odyssey completed a nearly trouble free aerobraking phase in January 2002. In 2006, Mars Reconnaissance Orbiter will also utilize aerobraking. From the flight operations standpoint, however, aerobraking is labor intensive and high risk due to the large density variability in the Mars thermosphere. The maximum rate of aerobraking is typically limited by the maximum allowable temperature of the solar array which is the primary drag surface. Prior missions have used a surrogate variable, usually maximum free stream heat flux, as a basis for performing periapsis altitude corridor control maneuvers. This paper provides an adaptive sequential method for operationally relating measured temperatures to heat flux profile characteristics and performing maneuvers based directly on measured temperatures and atmospheric properties derived from the heat flux profiles. Simulations of autonomous aerobraking are performed using Odyssey mission data.

Author

*Aerobraking; Mars Missions; Spacecraft Maneuvers; Aeromaneuvering; Flight Operations; Computerized Simulation; Temperature Profiles; Solar Arrays; Heat Flux*

**20030016693** NASA Johnson Space Center, Houston, TX USA

**STS-107 Crew Choice Television Highlights**

Jan. 31, 2003; In English; 20 min., 19 sec. playing time, in color, with sound

Report No.(s): NONP-NASA-VT-2003016044; BRF-1437P; No Copyright; Avail: CASI; B02, Videotape-Beta; V02, Videotape-VHS

The STS-107 flight day highlights begin with a shot inside the flight deck of the Space Shuttle Columbia where Commander Rick Husband, Pilot William McCool, and Mission Specialists David Brown and Kalpana Chawla are seated. The actual liftoff of the Space Shuttle Columbia is shown with Mission Specialists Michael Anderson and Laurel Clark, and Payload Specialist Ilan Ramon seated on the middeck of the spacecraft. Mission Specialist David Brown exits his seat to take pictures of the external tank while Michael Anderson also prepares to take photographs. A beautiful shot of the orbiter flying over Egypt is presented. A view of the Spacehab Research Double Module is shown where crystals are growing in microgravity. Laurel Clark is also shown working on the Bioreactor experiment. Michael Anderson is shown performing various breathing experiments in space. This video shows the last flight of STS-107 during ascent as the crew is seated in the flight deck and middeck of the Space Shuttle Columbia.

CASI

*Space Transportation System; Columbia (Orbiter); Spacecraft Modules; Microgravity; Ascent*

**20030016694** NASA Johnson Space Center, Houston, TX USA

**STS-114 Crew Interviews Eileen Collins, CDR**

Jan. 21, 2003; In English; 38 min., 15 sec. playing time, in color, with sound

Report No.(s): NONP-NASA-VT-2003013985; JSC-1936A; No Copyright; Avail: CASI; B03, Videotape-Beta; V03, Videotape-VHS

Commander Eileen Collins of the STS-114 space mission is seen during a pre-launch interview. She answers questions about the primary goals of the mission which are to exchange the expedition six and expedition seven crews. Also, she says that a large amount of logistics will be taken up to the International Space Station. The primary payload on this mission include: 1) The Utilization and Logistics Flight-1 (ULF-1); 2) Raffaello Multi-Purpose Logistics Module (MPLM); and 3) External Stowage Platform (ESP-2) which are all explained in detail by the Commander. The Window Observational Research Facility (WORF) rack, Human Research Facility (HRF) rack, Minus Eighty Degree Laboratory Freezer (MELF) and EXPRESS rack are the Space Station equipment to be installed on the International Space Station (I.S.S.). Collins is the Intravehicular Activity (IVA) specialist for this mission who oversees the three Extravehicular Activity (EVA)'s performed by Mission Specialists Soichi Noguchi and Stephen Robinson. The three EVA's include an external camera installation, positioning devices for an ammonia system and the installation of Floating Potential Measuring Unit (FPMU). Commander Collins expresses that she wants to have a successful mission, and also wants to see the Earth from space.

CASI

*Space Transportation System; Atlantis (Orbiter); Spacecrews; Space Missions; Space Station Modules; International Space Station*

**20030018443** NASA Johnson Space Center, Houston, TX USA

**STS-112 Mission Highlights Resource Tape, Part 1 of 3**

Jan. 22, 2003; In English; 59 min., 52 sec. playing time, in color, with sound

Report No.(s): JSC-1942; NONP-NASA-VT-2003009344; No Copyright; Avail: CASI; B03, Videotape-Beta; V03, Videotape-VHS

This video, Part 1 of 3, shows the activities of the STS-112 crew on flight days 1 - 3. The crew included Commander Jeff Ashby, Pilot Pam Melroy, and Mission Specialists Sandy Magnus, David Wolf, Piers Sellers, and Fyodor Yurchikhin. Flight day 1 begins with an introduction of the astronauts, seen during their pre-flight banquet, and suit-up. The ingress of some of the crew into the Space Shuttle Atlantis is shown. The launch footage includes the view from a camera mounted on the shuttle's external fuel tank, as well as replays. The separation of the shuttle's booster rockets is also shown. On flight day 2 a view of the payload bay and orbiter docking mechanism on Atlantis is shown from a camera on the shuttle's robotic arm. The footage of flight day

3 includes the docking of Atlantis and the International Space Station (ISS), and the exchange of greetings between the two spacecrews. Views of Earth include a pass over the western USA on flight day 2, and a night view of China on flight day 3.

Author

*Atlantis (Orbiter); Spacecrews; Liftoff (Launching); International Space Station; Spacecraft Docking*

**20030018444** NASA Johnson Space Center, Houston, TX USA

**STS-113 Post Flight Presentation**

Jan. 23, 2002; In English; 22 min., 24 sec. playing time, in color, with sound

Report No.(s): NONP-NASA-VT-2003018356; JSC-1945; No Copyright; Avail: CASI; B02, Videotape-Beta; V02, Videotape-VHS

The STS-113 post-flight presentation begins with a view of Mission Specialists Michael E. Lopez-Alegria and John B. Herrington getting suited for the space mission. The STS-113 crew consists of: Commander James D. Wetherbee, Pilot Paul Lockhart, Mission Specialists Michael Lopez-Alegria and John Herrington. Cosmonauts Valery Korzun, and Sergei Treschev, and astronaut Peggy Whitson who are all members of the expedition five crew, and Commander Kenneth Bowersox, Flight Engineers Nikolai Budarin and Donald Pettit, members of Expedition Six. The main goal of this mission is to take Expedition Six up to the International Space Station and Return Expedition Five to the Earth. The second objective is to install the P(1) Truss segment. Three hours prior to launch, the crew of Expedition Six along with James Wetherbee, Paul Lockhart, Michael Lopez-Alegria and John Herrington are shown walking to an astrovan, which takes them to the launch pad. The actual liftoff is presented. Three Extravehicular Activities (EVA)'s are performed on this mission. Michael Lopez-Alegria and John Herrington are shown performing EVA 1 and EVA 2 which include making connections between the P1 and S(0) Truss segments, and installing fluid jumpers. A panoramic view of the ISS with the Earth in the background is shown. The grand ceremony of the crew exchange is presented. The astronauts performing everyday duties such as brushing teeth, washing hair, sleeping, and eating pistachio nuts are shown. The actual landing of the Space Shuttle is presented.

CASI

*Space Transportation System; Space Missions; Space Shuttles; Extravehicular Activity; Spacecraft Maintenance*

17

**SPACE COMMUNICATIONS, SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING**

*Includes space systems telemetry; space communications networks; astronavigation and guidance; and spacecraft radio blackout. For related information, see also 04 Aircraft Communications and Navigation and 32 Communications and Radar.*

**20030014715** NASA Langley Research Center, Hampton, VA USA

**Integrated Power and Attitude Control for a Spacecraft with Flywheels and Control Moment Gyroscopes**

Roithmayr, Carlos M., NASA Langley Research Center, USA; Karlgaard, Christopher D., Analytical Mechanics Associates, Inc., USA; Kumar, Renjith R., Analytical Mechanics Associates, Inc., USA; Bose, David M., Analytical Mechanics Associates, Inc., USA; [2003]; 22p; In English; 13th AAS/AIAA Space Flight Mechanics Meeting, 9-13 Feb. 2003, Ponce, Puerto Rico; Sponsored by American Astronautical Society, USA

Report No.(s): AAS Paper 03-124; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A law is designed for simultaneous control of the orientation of an Earth-pointing spacecraft, the energy stored by counter-rotating flywheels, and the angular momentum of the flywheels and control moment gyroscopes used together as all integrated set of actuators for attitude control. General nonlinear equations of motion are presented in vector-dyadic form, and used to obtain approximate expressions which are then linearized in preparation for design of control laws that include feedback of flywheel kinetic energy error as it means of compensating for damping exerted by rotor bearings. Two flywheel 'steering laws' are developed such that torque commanded by all attitude control law is achieved while energy is stored or discharged at the required rate. Using the International Space Station as an example, numerical simulations are performed to demonstrate control about a torque equilibrium attitude and illustrate the benefits of kinetic energy error feedback.

Author

*Attitude Control; Control Moment Gyroscopes; Flywheels; Spacecraft Control; Actuators; Control Simulation; Computerized Simulation*

**20030016193** Instituto Nacional de Pesquisas Espaciais, Sao Jose dos Campos, Brazil

**Autonomous Orbit Navigator Development, Using GPS, Applied to Autonomous Orbit Control *Desenvolvimento de um Navegador Autonomo, Usando GPS, Aplicado ao Controle Autonomo de Orbita***

Galski, Roberto Luiz, Instituto Nacional de Pesquisas Espaciais, Brazil; 2002; 168p; In Portuguese  
Report No.(s): INPE-8982-TDI/813; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

The appearance of modern global positioning systems motivated the study and development of precise and robust systems for autonomous orbit determination of artificial satellites. These systems maintain, independently from human intervention from the ground, a precise knowledge of the satellite orbital state, through the processing of the information, autonomously generated on-board, by a receiver of the positioning system used. One of the major motivations for the research and development of autonomous navigators, is the availability of real time information about the position and velocity of the satellite, required, for instance, in earth observation missions, for interpretation and analysis of the generated images. The appearance of global positioning systems and the consequent development of autonomous navigators, by making available onboard space vehicles, updated orbit estimations, with good accuracy level, made feasible the research and development of orbit autonomous control procedures. It allowed the orbital maneuvers execution process to be performed in a way totally independent from ground human intervention. Whereas the satellite attitude control reached a high level of autonomy, due to the fact that the attitude measurements are, in general, naturally generated on-board the spacecraft, the orbit control is still now almost totally planned and executed from ground commanded actions. The proposed work consists of the study, development, simulation and analysis of a simplified navigator coupled to an autonomous orbit control system, applied to the China-Brazil Earth Resources Satellites (CBERS). At first, an autonomous orbit determination procedure is developed and analyzed. Its objective is to improve the coarse geometric solution provided by Global Positioning System (GPS) receivers. This will be done by directly using this solution as input (observation) for a real time Kalman filtering process. The orbital state vector will be extended in order to include the systematic error imposed to the GPS geometric solution due to changes in the set of satellites which are visible to the receiver. The improved outputs of this process will then be used in the implementation of an autonomous control system for the Longitude Phase Drift of the spacecraft orbit (parameter which presents the higher frequency of corrective maneuvers application for heliosynchronous orbits in phase with the earth's rotation, as is the case for the CBERS series satellites. Finally, the performance of the proposed autonomous control procedure will be analyzed and compared with the other results achieved by autonomous control systems previously studied at Instituto Nacional de Pesquisas Espaciais (INPE), that directly use the coarse GPS navigation solution

Author

*Orbit Determination; Artificial Satellites; Satellite Attitude Control; Automatic Control; Satellite Navigation Systems; Orbital Maneuvers*

**20030017748** NASA Langley Research Center, Hampton, VA USA

**Entry Vehicle Control System Design for the Mars Smart Lander**

Calhoun, Philip C., NASA Langley Research Center, USA; Queen, Eric M., NASA Langley Research Center, USA; 2002; 7p; In English; AIAA Atmospheric Flight Mechanics Conference and Exhibit, 5-8 Aug. 2002, Monterey, CA, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA; Original contains color illustrations  
Report No.(s): AIAA Paper 2002-4504; Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche; Distribution under U.S. Government purpose rights; Distribution under U.S. Government purpose rights

The NASA Langley Research Center, in cooperation with the Jet Propulsion Laboratory, participated in a preliminary design study of the Entry, Descent and Landing phase for the Mars Smart Lander Project. This concept utilizes advances in Guidance, Navigation and Control technology to significantly reduce uncertainty in the vehicle landed location on the Mars surface. A candidate entry vehicle controller based on the Reaction Control System controller for the Apollo Lunar Excursion Module digital autopilot is proposed for use in the entry vehicle attitude control. A slight modification to the phase plane controller is used to reduce jet-firing chattering while maintaining good control response for the Martian entry probe application. The controller performance is demonstrated in a six-degree-of-freedom simulation with representative aerodynamics.

Author

*Control Systems Design; Atmospheric Entry; Mars Missions; Mars Landing; Guidance (Motion); Navigation*

## SPACECRAFT DESIGN, TESTING AND PERFORMANCE

*Includes satellites; space platforms; space stations; spacecraft systems and components such as thermal and environmental controls; and spacecraft control and stability characteristics. For life support systems, see 54 Man/System Technology and Life Support. For related information, see also 05 Aircraft Design, Testing and Performance, 39 Structural Mechanics, and 16 Space Transportation and Safety.*

**20030014747** NASA Langley Research Center, Hampton, VA USA

### **Optimization Shield Materials Trade Study for Lunar/Gateway Mission**

Tripathi, R. K., NASA Langley Research Center, USA; Wilson, J. W., NASA Langley Research Center, USA; Cucinotta, F. A., NASA Johnson Space Center, USA; Anderson, B. M., NASA Langley Research Center, USA; Simonsen, L. C., NASA Langley Research Center, USA; [2002]; 7p; In English; 53rd International Astronautical Congress, 10-19 Oct. 2002, Houston, TX, Houston, TX, USA, USA; Original contains color illustrations; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The great cost of added radiation shielding is a potential limiting factor in many deep space missions. For this enabling technology, we are developing tools for optimized shield design over multi-segmented missions involving multiple work and living areas in the transport and duty phase of various space missions. The total shield mass over all pieces of equipment and habitats is optimized subject to career dose and dose rate constraints. Preliminary studies of deep space missions indicate that for long duration space missions, improved shield materials will be required. The details of this new method and its impact on space missions and other technologies will be discussed. This study will provide a vital tool for evaluating Gateway designs in their usage context. Providing protection against the hazards of space radiation is one of the challenges to the Gateway infrastructure designs. We will use the mission optimization software to scope the impact of Gateway operations on human exposures and the effectiveness of alternate shielding materials on Gateway infrastructure designs. It is being proposed to use Moon and the Lagrange points as the hub for deep space missions. This study will provide a guide to the effectiveness of multifunctional materials in preparation to more detailed geometry studies in progress.

Author

*Radiation Shielding; Design Optimization; Design Analysis*

**20030014811** NASA Langley Research Center, Hampton, VA USA

### **Aerodynamic Database Development for Mars Smart Lander Vehicle Configurations**

Bobskill, Glenn J., NASA Langley Research Center, USA; Parikh, Paresh C., NASA Langley Research Center, USA; Prabhu, Ramadas K., Lockheed Martin Engineering and Sciences Co., USA; Tyler, Erik D., Swales Aerospace, USA; 2002; 13p; In English; AIAA Atmospheric Flight Mechanics Conference and Exhibit, 5-8 Aug. 2002, Monterey, CA, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA; Original contains color illustrations

Report No.(s): AIAA Paper 2002-4411; Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche; Distribution as joint owner in the copyright; Distribution as joint owner in the copyright

An aerodynamic database has been generated for the Mars Smart Lander Shelf-All configuration using computational fluid dynamics (CFD) simulations. Three different CFD codes, USM3D and FELISA, based on unstructured grid technology and LAURA, an established and validated structured CFD code, were used. As part of this database development, the results for the Mars continuum were validated with experimental data and comparisons made where applicable. The validation of USM3D and LAURA with the Unitary experimental data, the use of intermediate LAURA check analyses, as well as the validation of FELISA with the Mach 6 CF(sub 4) experimental data provided a higher confidence in the ability for CFD to provide aerodynamic data in order to determine the static trim characteristics for longitudinal stability. The analyses of the noncontinuum regime showed the existence of multiple trim angles of attack that can be unstable or stable trim points. This information is needed to design guidance controller throughout the trajectory.

Author

*Aerodynamics; Data Bases; Spacecraft Configurations; Mars Landing; Mars Missions; Configuration Management*

**20030014819** Missouri Univ., Dept. of Mechanical and Aerospace, Rolla, MO USA

### **Design and Test of a Tethered Pair of Satellites: Equipment Requirements**

Pernicka, Henry J., Missouri Univ., USA; [2003]; 7p; In English

Contract(s)/Grant(s): NAG5-12589; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

A recent development in spacecraft mission design involves the increasing use of Distributed Spacecraft Systems (DSS). Several key technologies must mature sufficiently to facilitate these missions, including the use of spacecraft flying in tightly controlled formations. Such formations may be controlled using "free flying" navigation schemes, or alternatively may use tethers

to constrain the formation geometry. An investigation has been initiated here to further develop this technology using two small spacecraft connected by a short tether. After insertion into orbit, the tether will be extended and various data collected on the performance of the dual-spacecraft "formation." At some later time, the tether will be cut, and the spacecraft pair will be navigated in a manner to maintain a geometry as closely as possible to that of the tethered configuration. Comparisons and evaluations of the two modes of operation can then be made so that the merits of both approaches are available to mission designers.

Derived from text

*Equipment Specifications; Spacecraft Design; Tethering; Artificial Satellites*

**20030014831** NASA Langley Research Center, Hampton, VA USA

**Comet/Asteroid Protection System (CAPS): A Space-Based System Concept for Revolutionizing Earth Protection and Utilization of Near-Earth Objects**

Mazanek, Daniel D., NASA Langley Research Center, USA; Roithmayr, Carlos M., NASA Langley Research Center, USA; Antol, Jeffrey, NASA Langley Research Center, USA; Kay-Bunnell, Linda, George Washington Univ., USA; Werner, Martin R., George Washington Univ., USA; Park, Sang-Young, Swales Aerospace, USA; Kumar, Renjith R., Analytical Mechanics Associates, Inc., USA; [2002]; 18p; In English; 53rd International Astronautical Congress/The World Space Cong. 2002, 10-19 Oct. 2002, Houston, TX, USA; Sponsored by International Astronautical Congress, Unknown; Original contains color illustrations

Report No.(s): IAC-02-IAA.13.4/Q.5.1.01; Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche; Distribution as joint owner in the copyright; Distribution as joint owner in the copyright

There exists an infrequent, but significant hazard to life and property due to impacting asteroids and comets. There is currently no specific search for long-period comets, smaller near-Earth asteroids, or smaller short-period comets. These objects represent a threat with potentially little or no warning time using conventional ground-based telescopes. These planetary bodies also represent a significant resource for commercial exploitation, long-term sustained space exploration, and scientific research. The Comet/Asteroid Protection System (CAPS) would expand the current detection effort to include long-period comets, as well as small asteroids and short-period comets capable of regional destruction. A space-based detection system, despite being more costly and complex than Earth-based initiatives, is the most promising way of expanding the range of detectable objects, and surveying the entire celestial sky on a regular basis. CAPS is a future spacebased system concept that provides permanent, continuous asteroid and comet monitoring, and rapid, controlled modification of the orbital trajectories of selected bodies. CAPS would provide an orbit modification system capable of diverting kilometer class objects, and modifying the orbits of smaller asteroids for impact defense and resource utilization. This paper provides a summary of CAPS and discusses several key areas and technologies that are being investigated.

Author

*Asteroid Detection; Sky Surveys (Astronomy); Near Earth Objects; Astronomical Observatories; Spaceborne Telescopes; Risk; Tracking (Position); Deflection*

**20030015199** NASA Langley Research Center, Hampton, VA USA

**Space Operations Analysis Using the Synergistic Engineering Environment**

Angster, Scott, Analytical Mechanics Associates, Inc., USA; Brewer, Laura, NASA Langley Research Center, USA; [2002]; 10p; In English; 53rd International Astronautical Congress, 10-19 Oct. 2002, Houston, TX, Houston, TX, USA, USA; Original contains color illustrations; Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche; Distribution as joint owner in the copyright; Distribution as joint owner in the copyright

The Synergistic Engineering Environment has been under development at the NASA Langley Research Center to aid in the understanding of the operations of spacecraft. This is accomplished through the integration of multiple data sets, analysis tools, spacecraft geometric models, and a visualization environment to create an interactive virtual simulation of the spacecraft. Initially designed to support the needs of the International Space Station, the SEE has broadened the scope to include spacecraft ranging from low-earth orbit to deep space missions. Analysis capabilities within the SEE include rigid body dynamics, kinematics, orbital mechanics, and payload operations. This provides the user the ability to perform real-time interactive engineering analyses in areas including flight attitudes and maneuvers, visiting vehicle docking scenarios, robotic operations, plume impingement, field of view obscuration, and alternative assembly configurations. The SEE has been used to aid in the understanding of several operational procedures related to the International Space Station. This paper will address the capabilities of the first build of the SEE, present several use cases of the SEE, and discuss the next build of the SEE.

Author

*Aerospace Engineering; Virtual Reality; Spacecraft Control; Control Simulation; Systems Integration; Applications Programs (Computers); Data Integration*

**20030015805** NASA Langley Research Center, Hampton, VA USA

**Microwave-Driven Multifunctional Capability of Membrane Structures**

Choi, Sang H., NASA Langley Research Center, USA; Chu, Sang-Hyong, NASA Langley Research Center, USA; Song, Kyo D., Norfolk State Univ., USA; King, Glen C., NASA Langley Research Center, USA; [2002]; 7p; In English; AIAA NanoTech, 9-12 Sep. 2002, Houston, TX, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA; Original contains color illustrations

Contract(s)/Grant(s): NCC1-280; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

A large, ultra lightweight space structure, such as solar sails and Gossamer spacecrafts, requires a distributed power source to alleviate wire networks, unlike the localized on-board power infrastructures typically found in most small spacecrafts. The concept of microwave-driven multifunctional capability for membrane structures is envisioned as the best option to alleviate the complexity associated with hard-wired control circuitry and on-board power infrastructures. A rectenna array based on a patch configuration for high voltage output was developed to drive membrane actuators, sensors, probes, or other devices. Networked patch rectenna array receives and converts microwave power into a DC power for an array of smart actuators. To use microwave power effectively, the concept of a power allocation and distribution (PAD) circuit is adopted for networking a rectenna/actuator patch array. The use of patch rectennas adds a significant amount of rigidity to membrane flexibility and they are relatively heavy. A dipole rectenna array (DRA) appears to be ideal for thin-film membrane structures, since DRA is flexible and light. Preliminary design and fabrication of PAD circuitry that consists of a few nodal elements were made for laboratory testing. The networked actuators were tested to correlate the network coupling effect, power allocation and distribution, and response time.

Author

*Large Space Structures; Membrane Structures; Smart Structures; Microwaves; Spacecraft Power Supplies; Actuators; Rectennas*

**20030017769** NASA Langley Research Center, Hampton, VA USA

**Optimal Control Design using an H(sub 2) Method for the Glovebox Integrated Microgravity Isolation Technology (G-Limit)**

Calhoun, Philip C., NASA Langley Research Center, USA; Hampton, R. David, Military Academy, USA; 2002; 9p; In English; AIAA Guidance, Navigation, and Control Conference and Exhibit, 5-8 Aug. 2002, Monterey, CA, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Report No.(s): AIAA Paper 2002-5020; Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche; Distribution under U.S. Government purpose rights; Distribution under U.S. Government purpose rights

The acceleration environment on the International Space Station (ISS) will likely exceed the requirements of many micro-gravity experiments. The Glovebox Integrated Microgravity Isolation Technology (g-LIMIT) is being built by the NASA Marshall Space Flight Center to attenuate the nominal acceleration environment and provide some isolation for microgravity science experiments. G-LIMIT uses Lorentz (voice-coil) magnetic actuators to isolate a platform for mounting science payloads from the nominal acceleration environment. The system utilizes payload acceleration, relative position, and relative orientation measurements in a feedback controller to accomplish the vibration isolation task. The controller provides current commands to six magnetic actuators, producing the required experiment isolation from the ISS acceleration environment. This paper presents the development of a candidate control law to meet the acceleration attenuation requirements for the g-LIMIT experiment platform. The controller design is developed using linear optimal control techniques for frequency-weighted H(sub 2) norms. Comparison of the performance and robustness to plant uncertainty for this control design approach is included in the discussion.

Author

*Control Systems Design; Design Optimization; Microgravity; Vibration Isolators; Controllers*

**20030018262** Massachusetts Inst. of Tech., Dept. of Aeronautics and Astronautics, Cambridge, MA USA

**Agent Based Software for the Autonomous Control of Formation Flying Spacecraft *Annual Report, 15 Mar. 2002 - 14 Mar. 2003***

How, Jonathan P., Massachusetts Inst. of Tech., USA; Campbell, Mark, Massachusetts Inst. of Tech., USA; [2003]; 20p; In English  
Contract(s)/Grant(s): NAG5-10440

Report No.(s): MIT-OSP-6891850; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Distributed satellite systems is an enabling technology for many future NASA/DoD earth and space science missions, such as MMS, MAXIM, Leonardo, and LISA [1, 2, 3]. While formation flying offers significant science benefits, to reduce the operating costs for these missions it will be essential that these multiple vehicles effectively act as a single spacecraft by performing coordinated observations. Autonomous guidance, navigation, and control as part of a coordinated fleet-autonomy is a key technology that will help accomplish this complex goal. This is no small task, as most current space missions require significant input from the ground for even relatively simple decisions such as thruster burns. Work for the NMP DS1 mission

focused on the development of the New Millennium Remote Agent (NMRA) architecture for autonomous spacecraft control systems. NMRA integrates traditional real-time monitoring and control with components for constraint-based planning, robust multi-threaded execution, and model-based diagnosis and reconfiguration. The complexity of using an autonomous approach for space flight software was evident when most of its capabilities were stripped off prior to launch (although more capability was uplinked subsequently, and the resulting demonstration was very successful).

Derived from text

*Formation Flying; Autonomous Navigation; Automatic Control; Applications Programs (Computers); Spacecraft Control; Flight Control; Guidance (Motion)*

## 20

### SPACECRAFT PROPULSION AND POWER

*Includes main propulsion systems and components, e.g., rocket engines; and spacecraft auxiliary power sources. For related information, see also 07 Aircraft Propulsion and Power; 28 Propellants and Fuels; 15 Launch Vehicles and Launch Operations; and 44 Energy Production and Conversion.*

**20030014895** Air Force Safety Center, Kirkland AFB, NM USA

#### **Large Rocket Motor Hazard Classification Overview**

Olson, Eric T., Air Force Safety Center, USA; Vittitow, Patricia S., Army Space and Missile Defense Command, USA; 20th JANNAF Propulsion Systems Hazards Subcommittee Meeting; April 2002; Volume 1, pp. 47-75; In English; Also announced as 20030014891; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC

Outline: System examples. UN test series 6, test protocol. DoD issues. Need for revision. Changes to alternate test procedures in TB 700-2.

CASI

*Hazards; Rocket Engines; Performance Tests*

**20030014896** Air Force Research Lab., Propulsion Directorate, Edwards AFB, CA USA

#### **Current Efforts to Develop Alternate "TB 700-2" Test Protocols for the Hazard Classification of Large Rocket Motors**

Schwartz, Daniel F., Air Force Research Lab., USA; Bennett, Robert R., Thiokol Propulsion, USA; Graham, Kenneth J., Atlantic Research Corp., USA; Boggs, Thomas L., Naval Air Warfare Center, USA; Atwood, Alice I., Naval Air Warfare Center, USA; Butcher, A. Garn, Safety Management Services, Inc., USA; 20th JANNAF Propulsion Systems Hazards Subcommittee Meeting; April 2002; Volume 1, pp. 77-106; In English; Also announced as 20030014891; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC

When the Department of Defense (DoD) revised Technical Bulletin (TB) 700-2, NAVSEAINST 8020.8B, TO 11A-1-47, DLAR 8220.12 hazard classification guidelines in January 1998, it significantly changed the procedures used to determine the explosive classification of rocket motors, to be shipped or placed in DoD storage facilities. The revised test protocols outlined in this document, (hereafter referred to as TB 700-2) are far more conservative and costly to implement than the previous ones. These changes could have a profound impact on the solid rocket community and in particular those involved with the research and development and manufacture of large (less than or = 304.8-millimeter (less than or = 12-inch)) diameter solid rocket motors (SRMs). The ramifications may include higher development costs and limitations on performance improvements. This paper outlines current efforts of the solid rocket community to develop acceptable alternate test protocols for large rocket motors that could fulfill the intent of TB 700-2 and be considered by the Department of Defense Explosive Safety Board (DDESB) for incorporation into a future revision to TB 700-2.

Author

*Protocol (Computers); Solid Propellant Rocket Engines; Hazards; Classifications*

**20030015827** Air Force Research Lab., Propulsion Directorate West, Edwards AFB, CA USA

#### **Fracture Mechanics and Service Life Prediction Research**

Liu, C. T.; Sep. 08, 1999; 7p; In English

Contract(s)/Grant(s): AF Proj. 1011

Report No.(s): AD-A409488; AFRL-PR-ED-TP-FY99-0178; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The main issues in service life prediction of solid rocket motors are the lack of a fundamental understanding of crack growth behavior under service loading conditions and a reliable methodology to predict crack growth. It is relatively unknown in the areas of microstructure effects on damage initiation and evolution, large deformation effect on crack growth, and the effects of mismatch

of material properties of a bond system on the stress fields near the interfacial crack tip. This program consists of five major tasks: Task I predicting the initial crack length in high stress regions; Task II - crack instability and growth models; Task III - numerical modeling of crack growth; and Task IV - interfacial fracture of bimaterial bond systems. The program's basic approach involves a blend of analytical and experimental studies. In general, mechanisms and mechanics involved in cohesive fracture in a solid propellant and adhesive fracture in bond systems are emphasized. Program results will provide a basis for developing advanced crack growth and service life prediction technologies for predicting the service life of solid rocket motors. The implementation of these advanced technologies will not only increase the reliability of the solid rocket motors but also significantly reduce the motor replacement costs.

DTIC

*Fracture Mechanics; Mathematical Models; Service Life; Solid Propellant Rocket Engines; Crack Propagation*

**20030015831** Air Force Research Lab., Propulsion Directorate West, Edwards AFB, CA USA

**Influence of Gas-Surface Interaction Models on Predicted Performance of a Micro-Resistojet**

Ketsdever, Andrew D.; Wadsworth, Dean C.; Muntz, E. P.; Jun. 05, 2000; 21p; In English; Presented at the AIAA Thermophysics Conference held in Denver CO on 14-19 Jun. 2000

Contract(s)/Grant(s): AF Proj. 2308

Report No.(s): AD-A409495; AFRL-PR-ED-TP-2000-109; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Free Molecule Micro-Resistojet was designed as a micropropulsion system capable of performing attitude control and primary maneuvers for nanospacecraft with a mass of less than or equal to 10 kg. The details of gas-surface interactions between propellant molecules and surfaces held at elevated temperature are critical in predicting the propulsion system's performance and efficiency. The aim of this study is to parametrically assess the performance of a typical thruster geometry using a general Maxwell scattering model and two versions of the Cercignani-Lampis-Lord model. The models are incorporated into a Direct Simulation Monte Carlo numerical code and are used to bound the predicted performance characteristics of the thruster. The total specific impulse varies by approximately 20% over range of accommodation coefficients from specular to diffuse surface scattering. However, there was only a maximum difference of about 5% between the models for a given accommodation coefficient. Other more microscopic parameters, such as axial velocity distribution functions, appear to depend more on the scattering model used.

DTIC

*Low Thrust Propulsion; Microthrust; Resistojet Engines; Mathematical Models; Surface Reactions; Propulsion System Performance*

**20030015843** Thiokol Corp., Brigham City, UT USA

**Foam Inflated Rigidized Truss Structure Developed for an SRS Technologies Solar Concentrator**

Lester, Dean M.; Jan. 1996; 10p; In English

Report No.(s): AD-A409527; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

A foam inflated rigidized (KR) truss structure to support a single chamber solar concentrator has been developed and demonstrated. This technology promises to advance the state of the art in construction of lightweight, deployable solar concentrators for solar thermal propulsion applications. In this paper the design, analysis, deployment and integration of this structure are discussed. A KR structure is a rigid composite tube that can be formed in space by inflating a resin impregnated fabric skin with a solvent swollen polymeric foam. Once inflated, the skin resin is cured using the available ultraviolet radiation. by using high strength and stiffness fiber materials, a stiff, strong, lightweight structure is produced (Lester, 1994).

DTIC

*Inflating; Rigid Structures; Solar Collectors; Solar Thermal Propulsion; Trusses; Foams; Technology Utilization*

**20030015860** NASA Goddard Space Flight Center, Greenbelt, MD USA

**Technical Report Series on Global Modeling and Data Assimilation, Volume 22, A Coupled Ocean-Atmosphere Radiative Model for Global Ocean Biogeochemical Models**

Gregg, Watson W., NASA Goddard Space Flight Center, USA; Suarez, Max J., Editor, NASA Goddard Space Flight Center, USA; August 2002; 31p; In English

Report No.(s): NASA/TM-2002-104606/VOL22; NAS 1.15:104606/VOL22; Rept-2002-02197-0/VOL2; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

An ocean-atmosphere radiative model (OARM) evaluates irradiance availability and quality in the water column to support phytoplankton growth and drive ocean thermodynamics. An atmospheric component incorporates spectral and directional effects of clear and cloudy skies as a function of atmospheric optical constituents, and spectral reflectance across the air-sea interface. An oceanic component evaluates the propagation of spectral and directional irradiance through the water column as a function

of water, five phytoplankton groups, and chromophoric dissolved organic matter. It tracks the direct and diffuse streams from the atmospheric component, and a third stream, upwelling diffuse irradiance. The atmospheric component of OARM was compared to data sources at the ocean surface with a coefficient of determination ( $r^2$ ) of 0.97 and a root mean square of 12.1%.

Author

*Ocean Models; Atmospheric Models; Air Water Interactions; Irradiance*

**20030016687** NASA Glenn Research Center, Cleveland, OH USA

**Experimental Results From a 2kW Brayton Power Conversion Unit**

Hervol, David, Analex Corp., USA; Mason, Lee, NASA Glenn Research Center, USA; Birchenough, Arthur, NASA Glenn Research Center, USA; January 2003; 14p; In English; Space Technology and Applications International Forum (STAIF-2003), 2-6 Feb. 2003, Albuquerque, NM, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA; Original contains color illustrations

Contract(s)/Grant(s): RTOP 800-90-01

Report No.(s): NASA/TM-2003-211999; NAS 1.15:211999; E-13671; Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche; Distribution as joint owner in the copyright; Distribution as joint owner in the copyright

This paper presents experimental test results from operation of a 2 kWe Brayton power conversion unit. The Brayton converter was developed for a solar dynamic power system flight experiment planned for the Mir Space Station in 1997. The flight experiment was cancelled, but the converter was tested at Glenn Research Center as part of the Solar Dynamic Ground Test Demonstration system which included a solar concentrator, heat receiver, and space radiator. In preparation for the current testing, the heat receiver was removed and replaced with an electrical resistance heater, simulating the thermal input of a steady-state nuclear source. The converter was operated over a full range of thermal input power levels and rotor speeds to generate an overall performance map. The converter unit will serve as the centerpiece of a Nuclear Electric Propulsion Testbed at Glenn. Future potential uses for the Testbed include high voltage electrical controller development, integrated electric thruster testing and advanced radiator demonstration testing to help guide high power Brayton technology development for Nuclear Electric Propulsion (NEP).

Author

*Brayton Cycle; Power Converters; Nuclear Electric Propulsion; Energy Conversion Efficiency; Nuclear Electric Power Generation*

## 23

### CHEMISTRY AND MATERIALS (GENERAL)

*Includes general research topics related to the composition, properties, structure, and use of chemical compounds and materials as they relate to aircraft, launch vehicles, and spacecraft. For specific topics in chemistry and materials see categories 24 through 29. For astrochemistry see category 90 Astrophysics.*

**20030016712** Istituto Superiore di Sanita, Rome, Italy

**S-phenylmercapturic Acid Determination through Liquid Chromatography and Mass Spectrometry with Ion Trap**  
*Determinazione dell'acido S-fenilmercapturico mediante cromatografia liquida accoppiata a spettrometria di massa con trappola ionica*

La Rocca, C.; Baldassarri, L. T.; Casella, M. L.; 2002; 72p; In Italian

Report No.(s): PB2003-102603; ISTISAN-02/11; Copyright; Avail: National Technical Information Service (NTIS), Microfiche

An analytical method was set up to determine S-phenylmercapturic acid (S-PMA), a benzene urinary metabolite and a specific biomarker. The method is based on HPLC-MS/MS with an electrospray interface and an ion trap analyzer. The separation of the analyte is performed on a pre-treated urine extract by a reversed-phase C18 column; a linear gradient elution is used, whilst the determination is carried out on the daughter ion obtained by fragmentation (MS/MS) of the isolated (M+1)<sup>+</sup> ion, in the positive-ion polarity. The (M+1)<sup>+</sup>, is formed by S-PMA protonation. This study was first set up on S-PMA standard solutions and then tested on a real urine sample of a non professionally exposed subject. The instrumental analytical method developed in this study for the S-phenylmercapturic acid is characterized by a good precision (coefficient of variation= 4.57% in 5 replicated injections), a satisfactory accuracy (an estimated 6.46%) and a high sensitivity (10 pg of injected analyte); it allows determination of the benzene urinary metabolite even at the low levels occurring in environmental exposures. The method sensitivity is

comparable to spectrofluorimetric detectors, although these need one derivatization step, and it is better than gas chromatographic- mass spectrometric methods, which also need derivatization.

NTIS

*Benzene; Gas Chromatography; Liquid Chromatography; Mass Spectroscopy; Metabolites*

**20030016760** Istituto Superiore di Sanita, Rome, Italy

**Clostridium Perfringens as an Environmental Pollution Indicator and Its Hygienic Role** *Clostridium perfringens come indicatore di contaminazione ambientale e suo significato sanitario*

Bonadonna, L.; Briancesco, R.; D'Angelo, A. M.; Marini, R.; 2002; 48p; In Italian

Report No.(s): PB2003-102600; ISTISAN-02/8; Copyright; Avail: National Technical Information Service (NTIS), Microfiche

Results obtained during an investigation on different environmental matrices are reported. The study focused on the potential validity of Clostridium perfringens as efficient indicator of treatment for products of composting and wastewater. Significant results were observed in relation to both some correlations with other microorganisms and its capability to persist longer during hygienic treatments.

NTIS

*Bacteria; Clostridium; Composting*

**20030016761** Swedish Water and Air Pollution Research Lab., Stockholm, Sweden

**A Site-Specific Evaluation of Contaminated Soil-Biological Assays Combined with Chemical Analysis** *Platsspecifik Bedoemning av Foerorenad Mark - Biologiska Tester i Kombination med Kemiska Analyser*

Allard, A. S.; Malmberg, M.; Remberger, M.; Sep. 2002; In Swedish

Report No.(s): PB2003-102619; IVL-B-1492; Copyright; Avail: National Technical Information Service (NTIS), CD-ROM

There are substantial numbers of contaminated sites in Sweden. Each of these is unique and it is important from both an environmental and economic point of view to provide a comprehensive evaluation of these sites. to provide a site-specific environmental evaluation, it is necessary that appropriate procedures be used for characterizing the samples. to achieve this, IVL has developed a methodology that incorporates biological assays, chemical analysis and evaluation of the leaching potential of the contaminants. The bioassays are directed to determining the toxicity of the contaminants that are present, their recalcitrance and their bioavailability at the contaminated site. Since contaminants may effect biota differentially, the set of bioassays has been extended to include bacteria, higher plants and worms that represent different levels in the food chain.

NTIS

*Chemical Analysis; Soil Pollution; Bioassay*

## 24

### COMPOSITE MATERIALS

*Includes physical, chemical, and mechanical properties of laminates and other composite materials.*

**20030014745** Lockheed Martin Engineering and Sciences Co., Hampton, VA USA

**Dynamic Mechanical Characterization of Thin Film Polymer Nanocomposites**

Herring, Helen M., Lockheed Martin Engineering and Sciences Co., USA; January 2003; 15p; In English

Contract(s)/Grant(s): NAS1-00135; RTOP 762-30-51-03

Report No.(s): NASA/CR-2003-212147; NAS 1.26:212147; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Many new materials are being produced for aerospace applications with the objective of maximizing certain ideal properties without sacrificing others. Polymer composites in various forms and configurations are being developed in an effort to provide lighter weight construction and better thermal and electrical properties and still maintain adequate strength and stability. to this end, thin film polymer nanocomposites, synthesized for the purpose of influencing electrical conductivity using metal oxide particles as filler without incurring losses in mechanical properties, were examined to determine elastic modulus and degree of dispersion of particles. The effects of various metal oxides on these properties will be discussed.

Author

*Thin Films; Nanocomposites; Mechanical Properties; Polymeric Films*

**20030015256** Air Force Research Lab., Materials and Manufacturing Directorate, Wright-Patterson AFB, OH USA

**Metallic Composites. Work Unit Directive (WUD) 56 Final Report, 1 Oct. 1995-29 Jan. 2002**

Miracle, Daniel B.; Jan. 2002; 12p; In English

Contract(s)/Grant(s): Proj-2306

Report No.(s): AD-A409499; AFRL-ML-WP-TM-2002-4195; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Contents include the following: books, books chapters, refereed, invited presentations and colloquia

CASI

*Directivity; Presentation; Composite Materials; Metals*

**20030015411** NASA Glenn Research Center, Cleveland, OH USA

**MAC/GMC 4.0 User's Manual: Example Problem Manual, Volume 3**

Bednarczyk, Brett A., Ohio Aerospace Inst., USA; Arnold, Steven M., NASA Glenn Research Center, USA; December 2002; 282p; In English; Original contains color illustrations

Contract(s)/Grant(s): RTOP 713-73-16; RTOP 708-87-05

Report No.(s): NASA/TM-2002-212077/VOL3; E-13725-3/VOL3; NAS 1.15:212077/VOL3; Copyright; Avail: CASI; A13, Hardcopy; A03, Microfiche; Distribution as joint owner in the copyright; Distribution as joint owner in the copyright

This document is the third volume in the three volume set of User's Manuals for the Micromechanics Analysis Code with Generalized Method of Cells Version 4.0 (MAC/GMC 4.0). Volume 1 is the Theory Manual, Volume 2 is the Keywords Manual, and this document is the Example Problems Manual. MAC/GMC 4.0 is a composite material and laminate analysis software program developed at the NASA Glenn Research Center. It is based on the generalized method of cells (GMC) micromechanics theory, which provides access to the local stress and strain fields in the composite material. This access grants GMC the ability to accommodate arbitrary local models for inelastic material behavior and various types of damage and failure analysis. MAC/GMC 4.0 has been built around GMC to provide the theory with a user-friendly framework, along with a library of local inelastic, damage, and failure models. Further, application of simulated thermo-mechanical loading, generation of output results, and selection of architectures to represent the composite material, have been automated in MAC/GMC 4.0. Finally, classical lamination theory has been implemented within MAC/GMC 4.0 wherein GMC is used to model the composite material response of each ply. Consequently, the full range of GMC composite material capabilities is available for analysis of arbitrary laminate configurations as well. This volume provides in-depth descriptions of 43 example problems, which were specially designed to highlight many of the most important capabilities of the code. The actual input files associated with each example problem are distributed with the MAC/GMC 4.0 software; thus providing the user with a convenient starting point for their own specialized problems of interest.

Author

*User Manuals (Computer Programs); Micromechanics; Elastic Properties; Laminates; Plastic Properties; Stress-Strain Relationships; Applications Programs (Computers)*

**20030015447** Air Force Research Lab., Materials and Manufacturing Directorate, Wright-Patterson AFB, OH USA

**High Temperature Composites. work Unit Directive (WUD) 53**

Kerans, Ronald J.; Sep. 2002; 22p; In English

Contract(s)/Grant(s): Proj-2306

Report No.(s): AD-A409403; AFRL-ML-WP-TP-2002-407; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

There were numerous interrelated issues that were addressed as a part of the composite interface control effort. Crack deflection is a complex function of the fracture properties of the constituents. Hence, in addition to designed oxide coatings for both oxide and non-oxide fibers, substantial activity has pursued understanding and controlling fiber degradation, isolating and understanding aspects of the failure process, designing processes, and tests that provide definitive criteria for evaluation. These efforts have resulted in the identification and solution of a persistent and pervasive problem with fiber degradation during coating. This has finally enabled evaluation of the coatings in real composites made both in-house and as part of numerous collaborations with industry, academe, and other government laboratories. This in turn led to the recent definitive proof of the viability of oxide coating approaches in real composites. With this recent definitive demonstration of oxide coating viability, the specific focus is shifting towards understanding how best to design the overall composite system to best employ the new coatings. The word 'design' is used in the sense of the choice of the basic constituents of the composites and the choice and execution of the nano and microstructures of the constituents, and the micro and macrostructures of the composites.

DTIC

*Composite Materials; Ceramic Coatings; Ceramics*

**20030015799** Air Force Research Lab., Propulsion Directorate West, Edwards AFB, CA USA

**Modelling of Plane Strain Interfacial Fracture in Incompressible Materials**

Miller, T. C.; May 12, 1998; 25p; In English

Contract(s)/Grant(s): Proj-1011

Report No.(s): AD-A409449; AFRL-PR-ED-TP-1998-078; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Numerical modelling of a photoelastic experiment is discussed. The experiment examined incompressible materials under plane strain conditions, which results in a simplified analysis due to a vanishing of the bimaterial parameter. The photoelastic experiment used the stress freezing method to determine near tip stresses in interfacial cracks in bimaterial specimens. Different crack orientations were used to produce different mode mixities. Photoelastic fringe patterns were analyzed to determine the magnitude and phase angle of the complex stress intensity factor. These experiments were modeled using a finite element analysis to determine the field variables near the tips of the interfacial cracks. Magnitudes of the complex stress intensity factors are found from A integral values, derived using the domain integral approach, and the phase angles are determined using extrapolation of the bond line traction data to  $r=0$ . The results show that this approach is a useful way to characterize completely the complex stress intensity factor in incompressible linear elastic bimaterial combinations under plane strain conditions.

DTIC

*Composite Materials; Incompressibility; Fracture Mechanics*

**20030015826** Air Force Research Lab., Space and Missile Propulsion Div., Edwards AFB, CA USA

**Carbon-Carbon Protective Tubes**

Jul. 19, 1999; 6p; In English

Report No.(s): AD-A409485; AFRL-PR-ED-TP-FY99-0168; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

High temperature protective tubes for the F-22 fighter's spin chute struts had to be acquired and installed quickly due to changing needs. The solution was found at the Propulsion Directorate, whose carbon-carbon in-situ densification process had already demonstrated rapid small-scale densification of high quality components at low cost. In May 1999, the Directorate's Propulsion Sciences Division was able to produce the needed components in just eight weeks. This time included the scaleup of the carbon-carbon in-situ process and the facilities to produce components of the required size. Other sources would have taken three to five months to produce similar components.

DTIC

*Carbon-Carbon Composites; Densification; In Situ Measurement; Pipes (Tubes)*

**20030015833** Air Force Research Lab., Space and Missile Propulsion Div., Edwards AFB, CA USA

**Mixed-Mode Fracture in a Rubbery Particulate Composite**

Miller, Timothy C.; Mar. 24, 1999; 4p; In English

Contract(s)/Grant(s): AF Proj. 1011

Report No.(s): AD-A409497; AFRL-PR-ED-TP-1999-0063; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Often cracks in rubbery particulate composites are found in the propellant grain of rocket motors and experience mixed-mode loading. These composites are made from a rubbery matrix with a high volume of rigid particles (70-80%). The cracks threaten structural integrity and can grow to catastrophic failure. Refinements in our predictive abilities yield cost savings by improving service life predictions. This work uses an approximate analysis to examine the crack behavior. This approach is practical and useful because it can be put to widespread use in industry.

DTIC

*Particulates; Numerical Analysis; Composite Materials; Mechanical Properties; Rubber; Structural Reliability; Cracking (Fracturing)*

**20030015862** NASA Kennedy Space Center, Cocoa Beach, FL USA

**Multipurpose Thermal Insulation Test Apparatus**

Fesmire, James E., Inventor, NASA Kennedy Space Center, USA; Augustynowicz, Stanislaw D., Inventor, NASA Kennedy Space Center, USA; Dec. 03, 2002; 13p; In English; Provisional US-Patent-Appl-SN-217317, filed 10 Jul. 2000

Patent Info.: Filed 9 Jul. 2001; NASA-Case-KSC-12108; US-Patent-6,487,866; US-Patent-Appl-SN-906011; US-Patent-Appl-SN-217317; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A multi-purpose thermal insulation test apparatus is used for testing insulation materials, or other components. The test apparatus is a fluid boil-off calorimeter system for calibrated measurement of the apparent thermal conductivity (k-value) of a specimen material at a fixed vacuum level. The apparatus includes an inner vessel for receiving a fluid with a normal boiling point below ambient temperature, such as liquid nitrogen, enclosed within a vacuum chamber. A cold mass assembly, including the inner vessel and thermal guards, is suspended from the top of the vacuum chamber. Handling tools attach to the cold mass assembly for convenient manipulation of the assembly and for the installation or wrapping of insulation test materials. Liquid nitrogen is typically supplied to the inner vessel using a fill tube with funnel. A single port through the top of the vacuum chamber facilitates

both filling and venting. Aerogel composite stacks with reflective films are fastened to the top and the bottom of the inner vessel as thermal guards. The comparative k-value of the insulation material is determined by measuring the boil-off flow rate of gas, the temperature differential across the insulation thickness, and the dimensions (length and diameters) of the test specimen.

Author

*Thermal Insulation; Calorimeters; Thermal Conductivity; Vacuum Chambers*

**20030018255** Cleveland State Univ., Cleveland, OH USA

**The Development of Engineering Tomography for Monolithic and Composite Materials and Components *Final Report, 1 Nov. 1997 - 31 Dec. 2002***

Hemann, John, Cleveland State Univ., USA; [2003]; 3p; In English

Contract(s)/Grant(s): NCC3-582; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

A list of research papers and reports completed on this final report are provided.

CASI

*Tomography; Composite Materials; Systems Engineering; Integrated Circuits*

## 25

### INORGANIC, ORGANIC AND PHYSICAL CHEMISTRY

*Includes the analysis, synthesis, and use inorganic and organic compounds; combustion theory; electrochemistry; and photochemistry. For related information see also 34 Fluid Dynamics and Thermodynamics, For astrochemistry see category 90 Astrophysics.*

**20030014743** NASA Ames Research Center, Moffett Field, CA USA

**Calculation of Supersonic Combustion Using Implicit Schemes**

Yoon, Seokkwan, NASA Ames Research Center, USA; [2003]; 5p; In English; AIAA 16th Computational Fluid Dynamics Conference, 23-26 Jun. 2003, Orlando, FL, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

One of the technology goals of NASA for advanced space transportation is to develop highly efficient propulsion systems to reduce the cost of payload for space missions. Developments of rockets for the second generation Reusable Launch Vehicle (RLV) in the past several years have been focused on low-cost versions of conventional engines. However, recent changes in the Integrated Space Transportation Program to build a crew transportation vehicle to extend the life of the Space Shuttle fleet might suggest that air-breathing rockets could reemerge as a possible propulsion system for the third generation RLV to replace the Space Shuttle after 2015. The weight of the oxygen tank exceeds thirty percent of the total weight of the Space Shuttle at launch while the payload is only one percent of the total weight. The air-breathing rocket propulsion systems, which consume oxygen in the air, offer clear advantages by making vehicles lighter and more efficient. Experience in the National Aerospace Plane Program in the late 1980s indicates that scramjet engines can achieve high specific impulse for low hypersonic vehicle speeds. Whether taking a form of Rocket Based Combined Cycle (RBCC) or Turbine Based Combined Cycle (TBCC), the scramjet is an essential mode of operation for air-breathing rockets. It is well known that fuel-air mixing and rapid combustion are of crucial importance for the success of scramjet engines since the spreading rate of the supersonic mixing layer decreases as the Mach number increases. A factored form of the Gauss-Seidel relaxation method has been widely used in hypersonic flow research since its first application to non-equilibrium flows. However, difficulties in stability and convergence have been encountered when there is strong interaction between fluid motion and chemical reaction, such as multiple fuel injection problems. The present paper reports the results from investigation of the effect of modifications to the original algorithm on the performance for multiple injectors.

Author

*Reusable Launch Vehicles; Supersonic Combustion Ramjet Engines; Rocket-Based Combined-Cycle Engines; Hypersonic Vehicles*

**20030014798** Texas Univ., Center for Transportation Research, Austin, TX USA

**Feasibility of Various Coatings for the Protection of Reinforcing Steel-Corrosion and Bond Testing *Progress Report, Mar. - Aug. 1999***

Seddelmeyer, J. D.; Deshpande, P. G.; Wheat, H. G.; Fowler, D. W.; Jirsa, J.; May 2000; 78p; In English  
Report No.(s): PB2003-101640; RR-4904-3; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

The objective of this research project is to investigate the corrosion and bond performance of different coatings and nontraditional metals in salt-contaminated concrete. All accelerated macrocell corrosion test is being carried out to determine the

behavior of galvanized, stainless steel-clad, epoxy-coated, PVC-coated, nylon-coated, and 304 stainless steel reinforcing bars cyclically exposed to chloride solution. to date, there has been no change in the readings to indicate that corrosion of the reinforcement has initiated. Pullout testing was conducted to compare the bond behavior of bars with different polymer coatings. There were not any significant differences observed in the bond behavior of the epoxy, PVC, and nylon coatings. Each coating type was able to achieve a similar maximum applied pullout force and exhibited similar load-slip behavior during testing.

NTIS

*Feasibility; Protective Coatings; Corrosion Tests; Steels; Concretes*

**20030014799** Texas Univ., Center for Transportation Research, Austin, TX USA

**Corrosion Performance of Polymer-Coated, Metal-Clad, and Other Rebars as Reinforcements in Concrete** *Progress Report, 99 Mar. - Aug. 1999*

Deshpande, P. G.; Seddelmeyer, J. D.; Wheat, H. G.; Fowler, D. W.; Jirsa, J.; May 2000; 74p; In English  
Report No.(s): PB2003-101639; RR-4904-2; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Corrosion of reinforcement in concrete has been a matter of great concern in recent years owing to the increase in consumption of deicing salts on highways and bridges in the USA. The problem has been traced to corrosion of reinforcement caused by chlorides present in deicing salts. Various polymer coatings and metal claddings have been proposed (by independent suppliers) in this project with a view to minimize the damage caused to reinforcements in concrete from corrosion owing to chlorides. Coatings include zinc (galvanized), several epoxies, polyvinyl chloride (PVC) coating, and Nylon 11 coating. A stainless steel-clad material is also included as well as pure stainless steel reinforcement bar. The corrosion performance tests include extensive macrocell testing, immersion tests of the polymer-coated rebars, and polarization resistance tests for the metallic rebars.

NTIS

*Steels; Protective Coatings; Reinforcing Materials; Corrosion Tests; Concrete Structures*

**20030015405** NASA Glenn Research Center, Cleveland, OH USA

**Spontaneous Raman Scattering Diagnostics for High-Pressure Gaseous Flames**

Kojima, Jun, NASA Glenn Research Center, USA; Nguyen, Quang-Viet, NASA Glenn Research Center, USA; Jun. 17, 2002; 9p; In English; 22nd AIAA Aerodynamic Measurement Technology and Ground Testing Conference, 24-27 Jun. 2002, Saint Louis, MO, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA; Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche; Distribution under U.S. Government purpose rights; Distribution under U.S. Government purpose rights

A high-pressure (up to 60 atm) gaseous burner facility with optical access that provides steady, reproducible flames with high precision, and the ability to use multiple fuel/oxidizer combinations has been developed. In addition, a high-performance spontaneous Raman scattering system for use in the above facility has also been developed. Together, the two systems will be used to acquire and establish a comprehensive Raman scattering spectral database for use as a quantitative high-pressure calibration of single-shot Raman scattering measurements in high-pressure combustion systems. Using these facilities, the Raman spectra of H<sub>2</sub>-Air flames were successfully measured at pressures up to 20 atm. The spectra demonstrated clear rotational and ro-vibrational Raman features of H<sub>2</sub>, N<sub>2</sub>, and H<sub>2</sub>O. theoretical Raman spectra of pure rotational H<sub>2</sub>, vibrational H<sub>2</sub>, and vibrational N<sub>2</sub> were calculated using a classical harmonic-oscillator model with pressure broadening effects and fitted to the data. At a gas temperature of 1889 K for a  $\phi = 1.34$  H<sub>2</sub>-Air flame, the model and the data showed good agreement, confirming a ro-vibrational equilibrium temperature.

Author

*Raman Spectra; Diagnosis; High Pressure; Hydrogen; Nitrogen; Water; Flames*

**20030015798** Academy of Sciences (USSR), Radio Technical Inst., Moscow, USSR

**Investigation of a Possibility of Application of the Under-Critical Microwave Streamer Gas Discharge for Ignition of Fuel in Jet Engines** *Final Report, 1 Jun. 2000-30 May 2001*

Khodataev, Kirill V.; Esakov, Igor I.; Grachev, Lev P.; May 2001; 86p; In English; Original contains color images  
Report No.(s): AD-A409448; No Copyright; Avail: Defense Technical Information Center (DTIC)

This report results from a contract tasking Federal State Unitary Firm Moscow Radio-Technical Institute RAS (FSUF MRTI RAS) as follows: The goal of presented project consists in experimental and theoretical investigations of the physics of the initiated undercritical streamer microwave discharge for creation of the principally new system of ignition of the fuel-mixture in the jet engine. Creation of the reliable system of ignition of the fuel-mixture in the jet engine that can ignite the fuel and also insure the second start the engine after its stop during a flight stays nowadays the important problem at supersonic and hypersonic speeds of flight. Experimental and theoretical investigations that are planned to be carried out in the frames of the project will allow to obtain the data about the properties of the this discharge in a gas flow (in the supersonic flow as well) at different characteristics

of the microwave radiation, fuel types and flow parameters. They will also allow to obtain the evaluation of the temperature and to demonstrate the possibility of the ignition of the flammable mixtures with the use of the microwave discharge. The data obtained during the project will allow coming to the preparation of the investigations on the real jet engine. Results of the laboratory experiments and theoretical investigations are of great scientific importance for the development of the fundamental physics of gas discharges. The data obtained during the investigation of the Initiated undercritical streamer microwave discharge in the high-speed flow will allow to develop the principally new system of the ignition of the fuel-mixture in the jet engines. The system of the ignition based on it will realize the volume-type fuel ignition over the whole combustion-chamber cross-section including the case of stoppage of the engine in flight. Besides, results obtained in the course of the fulfillment of the project will be of great value for other problems of plasma-gasdynamics.

DTIC

*Jet Engines; Ignition; Gas Discharges*

**20030015802** Army Research Lab., Weapons and Materials Research Directorate, Aberdeen Proving Ground, MD USA  
**Determining the Exempt Solvent Content of Coatings Using Gas Chromatography Final Report, Oct. 2001-Aug. 2002**

Patterson, Phillip; Lum, William; Dec. 2002; 12p; In English

Contract(s)/Grant(s): Proj-AH84

Report No.(s): AD-A409477; ARL-TN-194; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Coatings Team of the Polymers Research Branch has developed a method for the analysis of the exempt solvent content in pigmented coating materials using gas chromatography. This technical note outlines the instrument parameters and the sampling procedures established to perform the determination. A typical analysis is graphically presented with a brief explanation summarizing the tabulated results.

DTIC

*Coatings; Gas Chromatography*

**20030015847** Air Force Research Lab., Propulsion Directorate West, Edwards AFB, CA USA

**Use of Fluorine Chemistry for the Synthesis of Polynitrogen Compounds**

Christe, K. O.; Wilson, W. W.; Vij, A.; Vij, V.; Sheehy, J. A.; Apr. 18, 2000; 3p; In English; Pres: 16th International Symposium of Fluorine Chemistry, 23 Jul 2000, Durham, UK. Abstract only

Contract(s)/Grant(s): AF Proj. 2303

Report No.(s): AD-A409532; AFRL-PR-ED-AR-2000-076; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Fluorine chemistry plays an important role in the synthesis of novel polynitrogen compounds. Thus, the reaction of  $N_2F+AsF_6^-$  with  $HN_3$  in anhydrous HF solution has been shown to yield  $N_5+AsF_6^-$ , a white solid that is marginally stable at room temperature and represents the first new stable homoleptic polynitrogen species in more than 100 years.

DTIC

*Synthesis (Chemistry); Nitrogen Compounds; Polymers; Fluorine Organic Compounds*

**20030015857** Korea Univ., Dept. of Electrical Engineering, Seoul, Korea, Republic of

**Electrochemical Detection of Hybridized DNA Using Reduction of Methylene Blue**

Cho, S. B.; Hong, J. S.; Pak, Y. K.; Pak, J. J.; Oct. 25, 2001; 5p; In English; Papers from 23rd Annual International Conference of the IEEE Engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on CD-ROM

Report No.(s): AD-A409549; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

One of the important roles of a DNA sensor is the capability of detecting genetic diseases or mutations by analyzing DNA sequence. The electrochemical detection method can be simpler and cheaper than other methods available and hence this method was investigated in this paper. For a successful electrochemical detection, several aspects should be considered including chemical treatment of electrode surface, DNA immobilization on electrode, hybridization, choice of an intercalator to be bound to double strand DNA selectively, and an equipment for detecting and analyzing the output signal, The intercalator bound to double strand DNA results in an electrical current With the electrochemical detection method, double strand DNA was distinguished from single strand DNA or bare gold electrode by measuring reduction current of intercalator, Also, it was found that the reduction current of intercalator is proportional to the concentration of target DNA to be hybridized with probe DNA. Therefore, it is possible to realize a simple and cheap DNA sensor using the electrochemical detection method for DNA sequencing.

DTIC

*Electrochemistry; Detection; Methylene Blue; Genetics; Deoxyribonucleic Acid*

**20030016509** Michigan Univ., Dept. of Aerospace Engineering, Ann Arbor, MI USA

**Extinction and Scattering Properties of Soot Emitted from Buoyant Turbulent Diffusion Flames, Appendix F**

Krishnan, S. S., Michigan Univ., USA; Lin, K.-C., Michigan Univ., USA; Faeth, G. M., Michigan Univ., USA; Journal of Heat Transfer; April 2001; Volume 123, pp. 331-339; In English

Contract(s)/Grant(s): NIST-60NANB4D-1696; NIST-60NANB8D0084; NAG3-1878; NAG3-2048; Copyright; Avail: Issuing Activity

Extinction and scattering properties at wavelengths of 250-5200 nm were studied for soot emitted from buoyant turbulent diffusion flames in the long residence time regime where soot properties are independent of position in the overfire region and characteristic flame residence times. Flames burning in still air and fueled with gas (acetylene, ethylene, propane, and propylene) and liquid (benzene, toluene, cyclohexane, and n-heptane) hydrocarbon fuels were considered. Measured scattering patterns and ratios of total scattering/absorption cross sections were in good agreement with predictions based on the Rayleigh-Debye-Gans (RDG) scattering approximation in the visible. Measured depolarization ratios were roughly correlated by primary particle size parameter, suggesting potential for completing RDG methodology needed to make soot scattering predictions as well as providing a nonintrusive way to measure primary soot particle diameters. Measurements of dimensionless extinction coefficients were in good agreement with earlier measurements for similar soot populations and were independent of fuel type and wavelength except for reduced values as the near ultraviolet was approached. The ratios of the scattering/absorption refractive index functions were independent of fuel type within experimental uncertainties and were in good agreement with earlier measurements. The refractive index junction for absorption was similarly independent of fuel type but was larger than earlier reflectometry measurements in the infrared. Ratios of total scattering/absorption cross sections were relatively large in the visible and near infrared, with maximum values as large as 0.9 and with values as large as 0.2 at 2000 nm, suggesting greater potential for scattering from soot particles to affect flame radiation properties than previously thought.

Author

*Diffusion Flames; Turbulent Diffusion; Soot; Optical Measurement; Scattering; Chemical Reactions; Flame Propagation*

**20030016527** Michigan Univ., Dept. of Aerospace Engineering, Ann Arbor, MI USA

**Structure of the Soot Growth Region of Laminar Premixed Methane/Oxygen Flames, Appendix G**

Xu, F., Michigan Univ., USA; Faeth, G. M., Michigan Univ., USA; Combustion and Flame; 2000; ISSN 0010-2180; Volume 121, pp. 640-650; In English

Contract(s)/Grant(s): NAG3-1245; NAG3-1878; NAG3-2048; Copyright; Avail: Issuing Activity

The structure of the soot growth region of laminar premixed methane/oxygen flames (fuel-equivalence ratios of 1.60-2.77) was studied both experimentally and computationally. Measurements were carried out in flames stabilized on a flat flame burner operated at standard temperature and pressure, and included velocities by laser velocimetry, soot volume fractions by laser extinction, soot temperatures by multiline emission, gas temperatures (where soot was absent) by corrected fine-wire thermocouples, major gas species concentrations by sampling and gas chromatography, and hydrogen atom concentrations by the Li/LiOH technique in conjunction with atomic absorption to find the proportion of free lithium in the flames. The measured concentrations of major gas species were in reasonably good agreement with predictions based on the detailed mechanisms of Leung and Lindstedt, and Frenklach and coworkers. The measurements also confirmed predictions of both these mechanisms that H-atom concentrations are in local thermodynamic equilibrium throughout the soot growth region even through the concentrations of major gas species are not. Thus, present findings support recent evaluations of the hydrogen-abstraction/carbon-addition (HACA) soot growth mechanism in similar flames, where the approximation that H-atom concentrations were in local thermodynamic equilibrium was adopted, based on predictions using the two mechanisms, due to the absence of direct H-atom concentration measurements.

Author

*Premixed Flames; Flame Propagation; Chemical Reactions; Combustion Physics; Soot; Hydrogen Atoms; Thermodynamic Equilibrium; Mathematical Models*

**20030016529** Michigan Univ., Dept. of Aerospace Engineering, Ann Arbor, MI USA

**Hydrodynamic Suppression of Soot Formation in Laminar Coflowing Jet Diffusion Flames, Appendix C**

Dai, Z., Michigan Univ., USA; Faeth, G. M., Michigan Univ., USA; Proceedings of the Combustion Institute; 2000; Volume 28, pp. 2085-2092; In English

Contract(s)/Grant(s): NCC3-661; NAG3-1878; NAG3-2048; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Effects of flow (hydrodynamic) properties on limiting conditions for soot-free laminar non-premixed hydrocarbon/air flames (called laminar soot-point conditions) were studied, emphasizing non-buoyant laminar coflowing jet diffusion flames. Effects of air/fuel-stream velocity ratios were of particular interest; therefore, the experiments were carried out at reduced pressures to

minimize effects of flow acceleration due to the intrusion of buoyancy. Test conditions included reactant temperatures of 300 K; ambient pressures of 3.7-49 kPa; methane-, acetylene-, ethylene-, propane-, and methane-fueled flames burning in coflowing air with fuel-port diameters of 1.7, 3.2, and 6.4 mm, fuel jet Reynolds numbers of 18-121; air coflow velocities of 0-6 m/s; and air/fuel-stream velocity ratios of 0.003-70. Measurements included laminar soot-point flame lengths, laminar soot-point fuel flow rates, and laminar liftoff conditions. The measurements show that laminar soot-point flame lengths and fuel flow rates can be increased, broadening the range of fuel flow rates where the flames remain soot free, by increasing air/fuel-stream velocity ratios. The mechanism of this effect involves the magnitude and direction of flow velocities relative to the flame sheet where increased air/fuel-stream velocity ratios cause progressive reduction of flame residence times in the fuel-rich soot-formation region. The range of soot-free conditions is limited by both liftoff, particularly at low pressures, and the intrusion of effects of buoyancy on effective air/fuel-stream velocity ratios, particularly at high pressures. Effective correlations of laminar soot- and smoke-point flame lengths were also found in terms of a corrected fuel flow rate parameter, based on simplified analysis of laminar jet diffusion flame structure. The results show that laminar smoke-point flame lengths in coflowing air environments are roughly twice as long as soot-free (blue) flames under comparable conditions due to the presence of luminous soot particles under fuel-lean conditions when smoke-point conditions are approached. This is very similar to earlier findings concerning differences between laminar smoke- and sootpoint flame lengths in still environments.

Author

*Hydrodynamics; Diffusion Flames; Flow Velocity; Combustion Products; Fuel Flow; Combustion Chemistry; Soot; Chemical Reactions; Flame Propagation*

**20030016530** NASA Glenn Research Center, Cleveland, OH USA

**Smoke-Point Properties of Nonbuoyant Round Laminar Jet Diffusion Flames, Appendix B**

Urban, D. L., NASA Glenn Research Center, USA; Yuan, Z.-G., NASA Glenn Research Center, USA; Sunderland, P. B., NASA Glenn Research Center, USA; Lin, K.-C., Michigan Univ., USA; Dai, Z., Michigan Univ., USA; Faeth, G. M., Michigan Univ., USA; Proceedings of the Combustion Institute; 2000; Volume 28, pp. 1965-1972; In English

Contract(s)/Grant(s): NCC3-661; NAG3-1878; NAG3-2048; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The laminar smoke-point properties of non-buoyant round laminar jet diffusion flames were studied emphasizing results from long-duration (100-230 s) experiments at microgravity carried out in orbit aboard the space shuttle Columbia. Experimental conditions included ethylene- and propane-fueled flames burning in still air at an ambient temperature of 300 K, pressures of 35-130 kPa, jet exit diameters of 1.6 and 2.7 mm, jet exit velocities of 170-690 mm/s, jet exit Reynolds numbers of 46-172, characteristic flame residence times of 40-302 ms, and luminous flame lengths of 15-63 mm. Contrary to the normal-gravity laminar smoke point, in microgravity the onset of laminar smoke-point conditions involved two flame configurations: closed-tip flames with soot emissions along the flame axis and open-tip flames with soot emissions from an annular ring about the flame axis. Open-tip flames were observed at large characteristic flame residence times with the onset of soot emissions associated with radiative quenching near the flame tip: nevertheless, unified correlations of laminar smoke-point properties were obtained that included both flame configurations. Flame lengths at laminar smoke-point conditions were well correlated in terms of a corrected fuel flow rate suggested by a simplified analysis of flame shape. The present steady and nonbuoyant flames emitted soot more readily than non-buoyant flames in earlier tests using ground-based microgravity facilities and than buoyant flames at normal gravity, as a result of reduced effects of unsteadiness, flame disturbances, and buoyant motion. For example, present measurements of laminar smokepoint flame lengths at comparable conditions were up to 2.3 times shorter than ground-based microgravity measurements and up to 6.4 times shorter than buoyant flame measurements. Finally, present laminar smoke-point flame lengths were roughly inversely proportional to pressure to a degree that is a somewhat smaller than observed during earlier tests both at microgravity (using ground-based facilities) and at normal gravity,

Author

*Diffusion Flames; Laminar Flow; Microgravity; Combustion Chemistry; Laminar Boundary Layer; Soot; Turbulent Combustion; Combustion Physics*

**20030016531** Michigan Univ., Dept. of Aerospace Engineering, Ann Arbor, MI USA

**Laminar Soot Processes (LSP) Final Report, 1 Jun. 2000 - 31 Oct. 2002**

Dai, Z., Michigan Univ., USA; El-Leathy, A. M., Michigan Univ., USA; Kim, C. H., Michigan Univ., USA; Krishnan, S. S., Michigan Univ., USA; Lin, K.-C., Michigan Univ., USA; Xu, F., Michigan Univ., USA; Faeth, G. M., Michigan Univ., USA; Dec. 15, 2002; 58p; In English

Contract(s)/Grant(s): NAG3-2404

Report No.(s): GDL/GMF-02-03; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This is the final report of a research program considering the structure and the soot surface reaction properties of laminar nonpremixed (diffusion) flames. The study was limited to ground-based measurements of buoyant laminar jet diffusion flames at pressures of 0.1-1.0 atm. The motivation for the research is that soot formation in flames is a major unresolved problem of combustion science that influences the pollutant emissions, durability and performance of power and propulsion systems, as well as the potential for developing computational combustion. The investigation was divided into two phases considering the structure of laminar soot-containing diffusion flames and the soot surface reaction properties (soot surface growth and oxidation) of these flames, in turn. The first phase of the research addressed flame and soot structure properties of buoyant laminar jet diffusion flames at various pressures. The measurements showed that H, OH and O radical concentrations were generally in superequilibrium concentrations at atmospheric pressure but tended toward subequilibrium concentrations as pressures decreased. The measurements indicated that the original fuel decomposed into more robust compounds at elevated temperatures, such as acetylene (unless the original fuel was acetylene) and H, which are the major reactants for soot surface growth, and that the main effect of the parent fuel on soot surface growth involved its yield of acetylene and H for present test conditions. The second phase of the research addressed soot surface reaction properties, e.g., soot surface growth and surface oxidation. It was found that soot surface growth rates in both laminar premixed and diffusion flames were in good agreement, that these rates were relatively independent of fuel type, and that these rates could be correlated by the Hydrogen-Abstraction/Carbon-Addition (HACA) mechanisms of Colket and Hall (1994), Frenklach et al. (1990,1994), and Kazakov et al. (1995). It was also found that soot surface oxidation rates were relatively independent of fuel type, were not correlated with O<sub>2</sub>, CO<sub>2</sub>, H<sub>2</sub>O and O collision rates but were correlated with the collision rates of OH with a collision efficiency of 0.14, in agreement with the early measurements in premixed flames of Neoh et al. (1980), after allowing for oxidation by O<sub>2</sub> via the classical rate expression of Nagle and Strickland-Constable (1962).

Author

*Soot; Diffusion Flames; Jet Flow; Propulsion System Performance; Surface Reactions; Combustion; Laminar Flow*

**20030016543** Iowa Univ., Dept. of Chemical and Biochemical Engineering, Iowa City, IA USA

**Research News: Emulsion Liquid Membrane Extraction in a Hollow-Fiber Contactor**

Wienczek, John M., Iowa Univ., USA; Hu, Shih-Yao, Iowa Univ., USA; Chemical Engineering and Technology; [2000]; ISSN 0930-07516; Volume 23, No. 6, pp. 551-553; In English

Contract(s)/Grant(s): NAG8-1588; Copyright; Avail: Issuing Activity

This article describes how ELMs (emulsion liquid membranes) can be used for extraction. The article addresses the disadvantages of ELM extraction in a stirred contactor, and the advantages of SELMs (supported emulsion liquid membranes). The introduction of the article provides background information on liquid-liquid solvent extraction and dispersion-free solvent extraction.

CASI

*Contactors; Emulsions; Extraction; Membranes; Fibers*

**20030016544** Iowa Univ., Dept. of Chemical and Biochemical Engineering, Iowa City, IA USA

**Rejuvenation of Spent Media via Supported Emulsion Liquid Membranes Final Report, 1 Mar. 1999 - 30 Nov. 2002**

Wienczek, John M., Iowa Univ., USA; [2002]; 4p; In English

Contract(s)/Grant(s): NAG8-1588; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The overall goal of this project is to maximize the reuseability of spent fermentation media. Supported emulsion liquid membrane separation, a highly efficient extraction technique, is used to remove inhibitory byproducts during fermentation; thus, improving the yield while reducing the need for fresh water. The key objectives of this study are: Develop an emulsion liquid membrane system targeting low molecular weight organic acids which has minimal toxicity on a variety of microbial systems; Conduct mass transfer studies to allow proper modeling and design of a supported emulsion liquid membrane system; Investigate the effect of gravity on emulsion coalescence within the membrane unit; Access the effect of water re-use on fermentation yields in a model microbial system; Develop a perfusion-type fermentor utilizing a supported emulsion liquid membrane system to control inhibitory fermentation byproducts; Work for the coming year will focus on the determination of toxicity of various solvents, selection of the emulsifying agents, as well as characterizing the mass transfer of hollow-fiber contactors.

Author

*Membranes; Emulsions; Fermentation; Waste Utilization; Separation; By-Products; Reuse; Microorganisms*

20030016579 Argonne National Lab., IL USA

**Probing the Phase Diagram of Bi(sub 2)SR(sub 2)CaCu(sub 2)O(sub 8 + delta) with Tunneling Spectroscopy**

Ozyuzer, L.; Zasadzinski, J. F.; Gray, K. E.; Hinks, D. G.; Miyakawa, N.; 2002; 8p; In English

Report No.(s): DE2002-801592; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Tunneling measurements are performed on Ca-rich single crystals of Bi (sub 2)2SR(sub 2)2CaCu(Sub 2)2O(sub 8) plus delta (Bi2212), with various oxygen doping levels, using a novel point contact method. At 4.2 K, SIN and SIS tunnel junctions are obtained with well-defined quasiparticle peaks, robust dip and hump features and in some cases Josephson currents. The doping dependence of tunneling conductances of Ca-rich Bi2212 are analyzed and compared to stoichiometric Bi2212. A similar profile of energy gap vs. doping concentration is found although the Ca-rich samples have a slightly smaller optimum Tc and therefore smaller gap values for any doping level. The evolution of tunneling conductance peak height to background ratios with hole concentration are compared. For a given doping level, the Ca-rich spectra showed more broadened features compared to the stoichiometric counterparts, most likely due to increased disorder from the excess Ca. Comparison of the dip and hump features has provided some potential insights into their origins.

NTIS

*Crystals; Phase Diagrams; Single Crystals; Elementary Excitations; Electric Contacts*

20030016582 Iowa Univ., Dept. of Chemical and Biochemical Engineering, Iowa City, IA USA

**Feasibility of Surfactant-Free Supported Emulsion Liquid Membrane Extraction**

Hu, Shih-Yao B., Iowa Univ., USA; Li, Jin, Iowa Univ., USA; Wiencek, John M., Iowa Univ., USA; [2001]; 30p; In English

Contract(s)/Grant(s): NAG8-1588; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Supported emulsion liquid membrane (SELM) is an effective means to conduct liquid-liquid extraction. SELM extraction is particularly attractive for separation tasks in the microgravity environment where density difference between the solvent and the internal phase of the emulsion is inconsequential and a stable dispersion can be maintained without surfactant. In this research, dispersed two-phase flow in SELM extraction is modeled using the Lagrangian method. The results show that SELM extraction process in the microgravity environment can be simulated on earth by matching the density of the solvent and the stripping phase. Feasibility of surfactant-free SELM (SFSELM) extraction is assessed by studying the coalescence behavior of the internal phase in the absence of the surfactant. Although the contacting area between the solvent and the internal phase in SFSELM extraction is significantly less than the area provided by regular emulsion due to drop coalescence, it is comparable to the area provided by a typical hollow-fiber membrane. Thus, the stripping process is highly unlikely to become the rate-limiting step in SFSELM extraction. SFSELM remains an effective way to achieve simultaneous extraction and stripping and is able to eliminate the equilibrium limitation in the typical solvent extraction processes. The SFSELM design is similar to the supported liquid membrane design in some aspects.

Author

*Emulsions; Membranes; Solvent Extraction; Propionic Acid; Two Phase Flow*

20030016583 Iowa Univ., Dept. of Chemical and Biochemical Engineering, Iowa City, IA USA

**Development of a Supported Emulsion Liquid Membrane System for Propionic Acid Separation in a Microgravity Environment**

Li, Jin, Iowa Univ., USA; Hu, Shih-Yao B., Iowa Univ., USA; Wiencek, John M., Iowa Univ., USA; Biotechnol. Bioprocess Eng.; [2001]; Volume 6, No. 6, pp. 426-432; In English

Contract(s)/Grant(s): NAG8-1588; Copyright; Avail: Issuing Activity

Perstractive fermentation is a good way to increase the productivity of bioreactors. Using Propionibacteria as the model system, the feasibility of using supported emulsion liquid membrane (SELM) for perstractive fermentation is assessed in this study. Five industrial solvents were considered as the solvent for preparing the SELM. The more polar a solvent is, the higher the partition coefficient. However, toxicity of a solvent also increases with its polarity. CO-1055 (industrial decanol/octanol blend) has the highest partition coefficient toward propionic acid among the solvents that has no molecular toxicity toward Propionibacteria. A preliminary extraction study was conducted using tetradecane as solvent in a hydrophobic hollow fiber contactor. The result confirmed that SELM eliminates the equilibrium limitation of conventional liquid-liquid extraction, and allows the use of a non-toxic solvent with low partition coefficient.

Author

*Microgravity; Emulsions; Membranes; Extraction; Propionic Acid; Microorganisms; Fermentation*

**20030016584** Michigan Univ., Dept. of Aerospace Engineering, Ann Arbor, MI USA

**Soot Formation in Laminar Acetylene/Air Diffusion Flames at Atmospheric Pressure, Appendix H**

Xu, F., Michigan Univ., USA; Faeth, G. M., Michigan Univ., USA; Combustion and Flame; 2001; ISSN 0010-2180; Volume 125, pp. 804-819; In English

Contract(s)/Grant(s): NAG3-1245; NAG3-1878; NAG3-2048; Copyright; Avail: Issuing Activity

The flame structure and soot-formation (soot nucleation and growth) properties of axisymmetric laminar coflowing jet diffusion flames were studied experimentally. Test conditions involved acetylene-nitrogen jets burning in coflowing air at atmospheric pressure. Measurements were limited to the axes of the flames and included soot concentrations, soot temperatures, soot structure, major gas species concentrations, radical species (H, OH, and O) concentrations, and gas velocities. The results show that as distance increases along the axes of the flames, detectable soot formation begins when significant H concentrations are present, and ends when acetylene concentrations become small. Species potentially associated with soot oxidation-O<sub>2</sub>, CO<sub>2</sub>, H<sub>2</sub>O, O, and OH-are present throughout the soot-formation region so that soot formation and oxidation proceed at the same time. Strong rates of soot growth compared to soot nucleation early in the soot-formation process, combined with increased rates of soot nucleation and oxidation as soot formation proceeds, causes primary soot particle diameters to reach a maximum relatively early in the soot-formation process. Aggregation of primary soot particles proceeds, however, until the final stages of soot oxidation. Present measurements of soot growth (corrected for soot oxidation) in laminar diffusion flames were consistent with earlier measurements of soot growth in laminar premixed flames and exhibited encouraging agreement with existing hydrogen-abstraction/carbon-addition (HACA) soot growth mechanisms in the literature that were developed based on measurements within laminar premixed flames. Measured primary soot particle nucleation rates in the present laminar diffusion flames also were consistent with corresponding rates measured in laminar premixed flames and yielded a crude correlation in terms of acetylene and H concentrations and the temperature.

Author

*Soot; Diffusion Flames; Atmospheric Pressure; Flame Propagation; Chemical Reactions; Flow Characteristics; Models*

**20030016585** Michigan Univ., Dept. of Aerospace Engineering, Ann Arbor, MI USA

**Optical Properties in the Visible of Overfire Soot in Large Buoyant Turbulent Diffusion Flames, Appendix E**

Krishnan, S. S., Michigan Univ., USA; Lin, K.-C., Michigan Univ., USA; Faeth, G. M., Michigan Univ., USA; Journal of Heat Transfer; August 2000; ISSN 0022-1481; Volume 122, pp. 517-524; In English

Contract(s)/Grant(s): NIST-60NANB4D1696; NIST-60NANB8D0084; Copyright; Avail: Issuing Activity

Nonintrusive measurements of the optical properties of soot at visible wavelengths (351.2-800.0 nm) were completed for soot in the overfire region of large (2-7 kW) buoyant turbulent diffusion flames burning in still air at standard temperature and pressure, where soot properties are independent of position and characteristic flame residence time for a particular fuel. Soot from flames fueled with gaseous (acetylene, ethylene, propylene, and butadiene) and liquid (benzene, cyclohexane, toluene, and n-heptane) hydrocarbon fuels were studied. Scattering and extinction measurements were interpreted to find soot optical properties using the Rayleigh-Debye-Gans/polydisperse-fractal-aggregate theory after establishing that this theory provided good predictions of scattering patterns over the present test range. Effects of fuel type on soot optical properties were comparable to experimental uncertainties. Dimensionless extinction coefficients were relatively independent of wavelength for wavelengths of 400-800 nm and yielded a mean value of 8.4 in good agreement with earlier measurements. Present measurements of the refractive index function for absorption,  $E(m)$ , were in good agreement with earlier independent measurements of Dalzell and Sarofim and Stagg and Charalampopoulos. Present values of the refractive index function for scattering,  $F(m)$ , however, only agreed with these earlier measurements for wavelengths of 400-550 nm but otherwise increased with increasing wavelength more rapidly than the rest. The comparison between present and earlier measurements of the real and imaginary parts of the complex refractive index was similar to  $E(m)$  and  $F(m)$ .

Author

*Optical Properties; Nonintrusive Measurement; Soot; Buoyancy; Diffusion Flames; Turbulent Diffusion; Scattering*

**20030016586** Michigan Univ., Dept. of Aerospace Engineering, Ann Arbor, MI USA

**Flame and Soot Boundaries of Laminar Jet Diffusion Flames, Appendix A**

Xu, F., Michigan Univ., USA; Dai, Z., Michigan Univ., USA; Faeth, G. M., Michigan Univ., USA; AIAA Journal; December 2002; ISSN 0001-1452; Volume 40, No. 12, pp. 2439-2446; In English

Contract(s)/Grant(s): NCC3-661; NAG3-1878; NAG3-2048; Copyright; Avail: Issuing Activity

The shapes (flame-sheet and luminous-flame boundaries) or steady weakly buoyant round hydrocarbon-fueled laminar-jet diffusion flames in still and coflowing air were studied both experimentally and theoretically. Flame-sheet shapes were measured from photographs using a CH optical filter to distinguish flame-sheet boundaries in the presence of blue CO<sub>2</sub> and OH emissions

and yellow continuum radiation from soot. Present experimental conditions included acetylene-, methane-, propane-, and ethylene-fueled flames having initial reactant temperatures of 300 K, ambient pressures of 4-50 kPa, jet-exit Reynolds numbers of 3-54, initial air/fuel velocity ratios of 0-9, and luminous flame lengths of 5-55 mm; earlier measurements for propylene- and 1,3-butadiene-fueled flames for similar conditions were considered as well. Nonbuoyant flames in still air were observed at microgravity conditions; essentially nonbuoyant flames in coflowing air were observed at small pressures to control effects of buoyancy. Predictions of luminous flame boundaries from soot luminosity were limited to laminar smoke-point conditions, whereas predictions of flame-sheet boundaries ranged from soot-free to smoke-point conditions. Flame-shape predictions were based on simplified analyses using the boundary-layer approximations along with empirical parameters to distinguish flame-sheet and luminous-flame (at the laminar smoke point) boundaries. The comparison between measurements and predictions was remarkably good and showed that both flame-sheet and luminous-flame lengths are primarily controlled by fuel flow rates with lengths in coflowing air approaching 2/3 of the lengths in still air as coflowing air velocities are increased. Finally, luminous flame lengths at laminar smoke-point conditions were roughly twice as long as flame-sheet lengths at comparable conditions because of the presence of luminous soot particles in the fuel-lean region of the flames.

Author

*Laminar Boundary Layer; Diffusion Flames; Boundary Layer Combustion; Boundary Layer Flow; Shapes; Turbulent Flow; Soot; Luminosity*

**20030016587** Michigan Univ., Dept. of Aerospace Engineering, Ann Arbor, MI USA

**Soot Surface Growth in Laminar Hydrocarbon/Air Diffusion Flames, Appendix J**

El-Leathy, A. M., Michigan Univ., USA; Xu, F., Michigan Univ., USA; Kim, C. H., Michigan Univ., USA; Faeth, G. M., Michigan Univ., USA; [2003]; 39p; In English

Contract(s)/Grant(s): NAG3-1245; NAG3-1878; NAG3-2048; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The structure and soot surface growth properties of round laminar jet diffusion flames were studied experimentally. Measurements were made along the axes of ethylene-, propylene-propane- and acetylene-benzene-fueled flames burning in coflowing air at atmospheric pressure with the reactants at normal temperature. The measurements included soot structure, soot concentrations, soot temperatures, major gas species concentrations, some radical species (H, OH and O) concentrations, and gas velocities. These measurements yielded the local flame properties that are thought to affect soot surface growth as well as local soot surface growth rates. When present results were combined with similar earlier observations of acetylene-fueled laminar jet diffusion flames, the results suggested that soot surface growth involved decomposition of the original fuel to form acetylene and H, which were the main reactants for soot surface growth, and that the main effect of the parent fuel on soot surface growth involved its yield of acetylene and H for present test conditions. Thus, as the distance increased along the axes of the flames, soot formation (which was dominated by soot surface growth) began near the cool core of the flow once acetylene and H appeared together and ended near the flame sheet when acetylene disappeared. Species mainly responsible for soot oxidation - OH and O<sub>2</sub> were present throughout the soot formation region so that soot surface growth and oxidation proceeded at the same time. Present measurements of soot surface growth rates (corrected for soot surface oxidation) in laminar jet diffusion flames were consistent with earlier measurements of soot surface growth rates in laminar premixed flames and exhibited good agreement with existing Hydrogen-Abstraction/Carbon-Addition (HACA) soot surface growth mechanisms in the literature with steric factors in these mechanisms having values on the order of unity, as anticipated.

Author

*Soot; Oxidation; Laminar Flow; Diffusion Flames; Surface Properties; Chemical Reactions; Combustion Products; Nonintrusive Measurement; Gas Analysis*

**20030016588** Michigan Univ., Dept. of Aerospace Engineering, Ann Arbor, MI USA

**Soot Surface Oxidation in Laminar Hydrocarbon/Air Diffusion Flames at Atmospheric Pressure, Appendix I**

Xu, F., Michigan Univ., USA; El-Leathy, A. M., Michigan Univ., USA; Kim, C. H., Michigan Univ., USA; Faeth, G. M., Michigan Univ., USA; [2003]; 45p; In English

Contract(s)/Grant(s): NCC3-661; NAG3-1878; NAG3-2048; NAG3-2404; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Soot surface oxidation was studied experimentally in laminar hydrocarbon/air diffusion flames at atmospheric pressure. Measurements were carried out along the axes of round fuel jets burning in coflowing dry air considering acetylene-nitrogen, ethylene, propylene-nitrogen, propane and acetylene-benzene-nitrogen in the fuel stream. Measurements were limited to the initial stages of soot oxidation (carbon consumption less than 70%) where soot oxidation occurs at the surface of primary soot particles. The following properties were measured as a function of distance above the burner exit: soot concentrations by deconvoluted laser extinction, soot temperatures by deconvoluted multiline emission, soot structure by thermophoretic sampling

and analysis using Transmission Electron Microscopy (TEM), concentrations of major stable gas species (N<sub>2</sub>, H<sub>2</sub>O, H<sub>2</sub>, O<sub>2</sub>, CO, CO<sub>2</sub>, CH<sub>4</sub>, C<sub>2</sub>H<sub>2</sub>, C<sub>2</sub>H<sub>6</sub>, C<sub>3</sub>H<sub>6</sub>, C<sub>3</sub>H<sub>8</sub>, and C<sub>6</sub>H<sub>6</sub>) by sampling and gas chromatography, concentrations of some radical species (H, OH, O) by deconvoluted Li/LiOH atomic absorption and flow velocities by laser velocimetry. For present test conditions, it was found that soot surface oxidation rates were not affected by fuel type, that direct rates of soot surface oxidation by O<sub>2</sub> estimated from Nagle and Strickland-Constable (1962) were small compared to observed soot surface oxidation rates because soot surface oxidation was completed near the flame sheet where O<sub>2</sub> concentrations were less than 3% by volume, and that soot surface oxidation rates were described by the OH soot surface oxidation mechanism with a collision efficiency of 0.14 and an uncertainty (95% confidence) of +/- 0.04 when allowing for direct soot surface oxidation by O<sub>2</sub>, which is in reasonably good agreement with earlier observations of soot surface oxidation rates in both premixed and diffusion flames at atmospheric pressure.

Author

*Diffusion Flames; Atmospheric Pressure; Laminar Flow; Oxidation; Flow Measurement; Gas Analysis; Soot*

**20030016604** Michigan Univ., Dept. of Aerospace Engineering, Ann Arbor, MI USA

**State Relationships of Laminar Permanently-Blue Opposed-Jet Hydrocarbon-Fueled Diffusion Flames, Appendix D**

Lin, K.-C., Michigan Univ., USA; Faeth, G. M., Michigan Univ., USA; International Journal of Environ. Combustion Technology; [2000]; Volume 1, pp. 53-79; In English

Contract(s)/Grant(s): N00014-93-0321; NAG3-1245; NAG3-2048; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The structure and state relationships of laminar soot-free (permanently-blue) diffusion flames at various strain rates were studied experimentally using an opposed-jet configuration, motivated by the importance of soot-free hydrocarbon-fueled diffusion flames for many practical applications. Measurements of gas velocities, temperatures and compositions were carried out along the stagnation stream line. Flame conditions studied included propylene- and 1,3-butadiene-fueled opposed-jet diffusion flames having a stoichiometric mixture fractions of 0.7 and strain rates of 60-240 s<sup>-1</sup> (exp -1) at normal temperature and pressure. It was found that oxygen leakage to fuel-rich conditions and carbon monoxide leakage to fuel-lean conditions both increased as strain rates increased. Furthermore, increased strain rates caused increased fuel concentrations near the flame sheet, decreased peak gas temperatures, and decreased concentrations of carbon dioxide and water vapor throughout the flames. State relationships for major gas species and gas temperatures for these flames were found to exist over broad ranges of strain rates. In addition, current measurements, as well as previous measurements and predictions of ethylene-fueled permanently-blue diffusion flames, all having a stoichiometric mixture fraction of 0.7, were combined to establish generalized state relationships for permanently-blue diffusion flames for this stoichiometric mixture fraction. The combined measurements and predictions support relatively universal generalized state relationships for N<sub>2</sub>, CO<sub>2</sub>, H<sub>2</sub>O and fuel over a broad range of strain rates and fuel types. State relationships for O<sub>2</sub> in the fuel-rich region, and for CO in the fuel-lean region, however, are functions of strain rate and fuel type. State relationships for H<sub>2</sub> and temperature exhibit less universality, mainly due to the increased experimental uncertainties for these variables. The existence of state relationships for soot-free hydrocarbon-fueled diffusion flames provides potential for significant computational simplifications for modeling purposes in many instances, allowing for effects of finite-rate chemistry while avoiding time-consuming computations of Arrhenius expressions.

Author

*Diffusion Flames; Strain Rate; Chemical Reactions; Flame Propagation; Combustion Chemistry; Flow Characteristics; Models; Performance Prediction; Soot*

**20030017757** Kansas Univ., Lawrence, KS USA

**Evaluation of Corrosion Resistance of Type 304 Stainless Steel Clad Reinforcing Bars Final Report, Jan. - 2 Aug. 1999**

Darwin, D.; Kahrs, J. T.; Locke, C. E.; Sep. 2002; 96p; In English

Report No.(s): PB2003-101372; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

Corrosion of concrete reinforcement can be a major problem when concrete is continually subjected to deicing chemicals or saltwater. The cost of corrosion damage caused by deicing salts on reinforced concrete bridge decks and car parking structures has been estimated to cost the USA between \$325 and \$1000 million/year. For this reason, several methods are under study to protect reinforcing steel. Corrosion potential and macrocell corrosion tests were performed to compare the corrosion properties of conventional and type 304 stainless steel clad reinforcing bars.

NTIS

*Corrosion Resistance; Stainless Steels; Evaluation; Reinforcement (Structures)*

*Includes physical, chemical, and mechanical properties of metals and metallic materials; and metallurgy.*

**20030014740** NASA Glenn Research Center, Cleveland, OH USA

**Solar Selective Coatings for High Temperature Applications**

Jaworske, Donald A., NASA Glenn Research Center, USA; Shumway, Dean A., Brigham Young Univ., USA; Space Technology and Applications International Forum-STAIF 2003; 2003, pp. 65-70; In English

Report No.(s): CP-654; ISBN 0-7354-0114-4; Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche; Distribution as joint owner in the copyright; Distribution as joint owner in the copyright

Solar selective coatings are envisioned for use on minisatellites, for applications where solar energy is to be used to power heat engines or to provide thermal energy for remote regions in the interior of the spacecraft. These coatings are designed to have the combined properties of high solar absorptance and low infrared emittance. The coatings must be durable at elevated temperatures. For thermal bus applications, the temperature during operation is likely to be near 100 C. For heat engine applications, the temperature is expected to be much greater. The objective of this work was to screen candidate solar selective coatings for their high temperature durability. Candidate solar selective coatings were composed of molecular mixtures of metal and dielectric, including: nickel and aluminum oxide, titanium and aluminum oxide, and platinum and aluminum oxide. To identify high temperature durability, the solar absorptance and infrared emittance of the candidate coatings were evaluated initially, and after heating to temperatures in the range of 400 C to 700 C. The titanium and aluminum oxide molecular mixture was found to be the most durable.

Author

*Solar Energy Absorbers; Thermal Energy; Solar Energy; High Temperature; Coatings; Selective Surfaces*

**20030014802** NASA Langley Research Center, Hampton, VA USA

**Effects of Thermomechanical History on the Tensile Behavior of Nitinol Ribbon**

Lach, Cynthia L., NASA Langley Research Center, USA; Turner, Travis L., NASA Langley Research Center, USA; Taminger, Karen M., NASA Langley Research Center, USA; Shenoy, Ravi N., Lockheed Martin Corp., USA; [2002]; 12p; In English; SPIE's 9th Annual International Symposium on Smart Structures and Materials; Active Materials: Behavior and Mechanics, 17-21 Mar. 2002, San Diego, CA, USA; Sponsored by International Society for Optical Engineering, USA

Report No.(s): SPIE Paper 4699-45; Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche; Distribution as joint owner in the copyright; Distribution as joint owner in the copyright

Shape memory alloys (SMAs) have enormous potential for a wide variety of applications. A large body of work exists on the characterization of the microstructure and stress-strain behavior of these alloys, Nitinol (NiTi) in particular. However, many attributes of these materials are yet to be fully understood. Previous work at NASA Langley Research Center (LaRC) has included fabrication of hybrid composite specimens with embedded Nitinol actuators and modeling of their thermomechanical behavior. An intensive characterization effort has been undertaken to facilitate fundamental understanding of this alloy and to promote implementation of Nitinol in aerospace applications. Previous work revealed attributes of the Nitinol ribbon that were not easily rationalized with existing data in the literature. In particular, tensile behavior at ambient temperature showed significant dependence on the thermomechanical history prior to testing. The present work is focused on characterizing differences in the microstructure of Nitinol ribbons exposed to four different thermomechanical histories and correlation of the microstructure with tensile properties. Differential scanning calorimetry (DSC) and x-ray diffraction (XRD) analysis were employed to rationalize the microstructures present after exposure to various thermomechanical histories. Three of the Nitinol ribbon conditions were reversible upon heating (in the DSC) through the reverse transformation temperature ( $A_{(sub f)}$ ) to transform the microstructure to austenite. However, the prior thermomechanical conditioning for the Nitinol ribbon that reflected the entire fabrication procedure (4% thermal cycle condition) was found to have an irreversible effect on the microstructure, as it remained unchanged after repeated complete thermal cycles. Tensile tests were conducted to determine the effect of prior thermomechanical conditioning on both the tensile behavior of the Nitinol ribbons and the stress state of the microstructure. The stress-strain behavior of the Nitinol actuators appears to be governed by the interplay between two major variables: namely, microstructural constituents such as the R-phase and the martensite; and the stress state of these constituents (whether twinned with low residual stresses, or detwinned with high residual stresses). The most significant difference in the stress-strain behavior of the four conditions, the critical stress required to achieve an initial stress plateau, was found to depend on both the amount and stress state (twinned or detwinned) of R-phase present in the initial microstructure. Thus, the effect of prior thermomechanical processing is critical to

the resulting tensile behavior of the Nitinol actuator. For numerical modeling inputs one must take into account the entire fabrication process on the Nitinol actuator.

Author

*Nitinol Alloys; Stress-Strain Relationships; Microstructure; Tensile Properties; Ribbons; Thermodynamics; Actuators; Heat Measurement*

**20030014940** Instituto Nacional de Pesquisas Espaciais, Sao Jose dos Campos, Brazil

**A Flat Triangular Laminated Plate and Shell Element** *Um Elemento Triangular Plano Para Placas e Cascas Laminadas*

Goto, Sergio Tsuyoshi, Instituto Nacional de Pesquisas Espaciais, Brazil; 2002; 84p; In Portuguese

Report No.(s): INPE-9390-TDI/822; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

The six-node flat triangular element, herein presented for laminated plate and shell analysis, is based on Reissner-Mindlin theory. The mid-surface displacement components  $u$ ,  $v$ ,  $w$  and the rotation components  $u$ ,  $v$ ,  $w$   $\beta(\text{sub } x)$ ,  $\beta(\text{sub } y)$  of the normal to the mid-surface are approximated by quadratic polynomials. The quadratic variation of the transverse shear strain, as a result of the adopted approximation, is modified to fit a linear variation that avoids shear locking. The membrane locking possibility due to the joining of the membrane and bending rigidities in the interfaces of non-coplanar elements is discussed and exemplified. The membrane, bending, membrane-bending coupling and the transverse shear parts of the stiffness matrix are explicitly obtained and, with exception of the transverse shear part, have all the same algebraic pattern, what makes simple the element for computational implementation. Numerical results show the element good performance.

Author

*Stiffness Matrix; Shear Stress; Shear Strain; Laminates; Flat Plates*

**20030016515** Argonne National Lab., IL USA

**Observations of z-Dependent Microbunching Harmonic Intensities Using COTR in a SASE FEL**

Lumpkin, A. H.; Biedron, S. G.; Berg, W. J.; Dejus, R. J.; Borland, M.; Sep. 25, 2002; 16p; In English

Report No.(s): DE2002-801623; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The nonlinear generation of harmonics in a self-amplified spontaneous emission (SASE) free-electron laser (FEL) continues to be of interest. Complementary to such studies is the search for information on the electron beam microbunching harmonic components, which are revealed by coherent optical transition radiation (COTR) experiments. An initial z-dependent set of data has been obtained with the fundamental at 530 nm and the second harmonic at 265 nm. The latter data were collected after every other undulator in a nine-undulator string. These results are compared to estimates based on GINGER and an analytical model for nonlinear harmonic generation.

NTIS

*Harmonics; Harmonic Generations; Spontaneous Emission; Optical Transition*

**20030016542** Lawrence Livermore National Lab., Livermore, CA USA

**Comparison of the Crevice Corrosion Resistance of Alloys 625 and C22**

Kehler, B. A.; Scully, J. R.; Nov. 11, 1999; 18p; In English

Report No.(s): DE2002-792624; UCRL-JC-135852-R1; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The effects of electrolyte composition and oxide film age on the crevice corrosion properties of alloys 625 and C22 were studied at 95 C. Critical potentials were determined using conventional current density thresholds. Crevice stabilization potentials are influenced by the bulk electrolyte composition, oxide properties, and alloy dissolution behavior. Repassivation and deactivation potentials are controlled by the chemistry of the crevice solution, mass transport considerations, and the electrochemical properties of the alloys. Critical potential data also showed the large influence of air formed oxide film age on stabilization. Air aged C22 specimens exhibited the highest resistance to crevice corrosion in terms of critical crevice potentials, while freshly polished C22 exhibited the lowest resistance.

NTIS

*Corrosion Resistance; Containers; Radioactive Wastes; Deactivation; Mass Transfer*

**20030016679** Northwest Aluminum Technologies, The Dallas, OR USA

**Wetted Cathodes for Low-Temperature Aluminum Smelting Final Report**

Brown, C. W.; Sep. 30, 2002; In English; This document is color dependent and/or in landscape layout. It is currently only available on CD-ROM

Report No.(s): DE2002-801562; No Copyright; Avail: National Technical Information Service (NTIS)

A low-temperature aluminum smelting process being developed differs from the Hall-Heroult process in several significant ways. The low-temperature process employs a more acidic electrolyte than cryolite, an alumina slurry, oxygen-generating metal anodes, and vertically suspended electrodes. Wetted and drained vertical cathodes are crucial to the new process. Such cathodes represent a significant portion of the capital costs projected for the new technology. Although studies exist of wetted cathode technology with Hall-Heroult cells, the differences make such a study desirable with the new process. This project is such a study.

NTIS

*Cathodes; Smelting; Aluminum Oxides; Low Temperature*

**20030016681** Sandia National Labs., Albuquerque, NM USA

**High-Rate Shear Deformation and Failure in Structural Alloys**

Dawson, D. B.; Regueiro, R. A.; Ohashi, Y.; Ravichandran, G.; Viral, M.; Jun. 2002; In English; This document is color dependent and/or in landscape layout. It is currently only available on CD-ROM

Report No.(s): DE2002-801502; SAND2002-8285; No Copyright; Avail: National Technical Information Service (NTIS)

Experiments were conducted to determine the dynamic shear behavior of a wide range of aluminum, titanium, and steel alloys. Principal experimental techniques were the torsional Kolsky bar and the Shear Compression Specimen (SCS) geometry. For the purpose of determining adiabatic shear susceptibility in this range of alloys, it was found that both techniques were unable to induce adiabatic shear in alloys resistant to that failure mode. The SCS geometry has demonstrated a capability for characterizing shear deformation behavior over a wide range of strain rates. For modeling and simulation of adiabatic shear phenomena, an improved adiabatic temperature evolution equation has been implemented. Finite element simulations of the torsional Kolsky and SCS geometries were conducted to evaluate the influence of pre-existing geometric inhomogeneities on adiabatic shear band initiation.

NTIS

*Deformation; Shear Properties; Shear Creep; Structural Engineering; Strain Rate*

**20030016682** Bettis Atomic Power Lab., West Mifflin, PA USA

**Stress Corrosion Crack Growth Rates for EN82H Welds**

Mills, W. J.; Brown, C. M.; Sep. 2001; In English; This document is color dependent and/or in landscape layout. It is currently only available on CD-ROM

Report No.(s): DE2002-799499; B-T-3411; No Copyright; Avail: National Technical Information Service (NTIS)

The report investigates the stress corrosion crack growth rates for EN82H metal welds. Tests include immersion in 360 deg C. water. Stress Corrosion Cracking (SCC) rates were based on Linear Variable Dimension Transformer (LVDT) measured CMOD.

NTIS

*Stress Corrosion Cracking; Crack Propagation; Nuclear Power Plants*

**20030017762** Pennsylvania State Univ., University Park, PA USA

**Fillability of Thin-Wall Steel Castings Final Report**

Voigt, R. C.; Jul. 2002; In English; This document is color dependent and/or in landscape layout. It is currently only available on CD-ROM

Report No.(s): DE2002-801749; No Copyright; Avail: National Technical Information Service (NTIS)

The use of steel components is being challenged by lighter nonferrous or cast iron components. The development of techniques for enhancing and ensuring the fillability of thin-wall mold cavities is most critical for thinner wall cast steel production. The purpose of this research was to develop thin-wall casting techniques that can be used to reliably produce thin-wall castings from traditional gravity poured sand casting processes. The focus of the research was to enhance the filling behavior to prevent miss runs. Experiments were conducted to investigate the influence of various foundry variables on the filling of thin section steel castings. These variables include casting design, heat transfer, gating design, and metal fluidity. Wall thickness and pouring temperature have the greatest effect on casting fill. As wall thickness increases the volume to surface area of the casting increases, which increases the solidification time, allowing the metal to flow further in thicker sections. Pouring time is another significant variable affecting casting fill. Increases or decreases of 20% in the pouring time were found to have a significant effect on the filling of thin-wall production castings. Gating variables, including venting, pouring head height, and mold tilting also significantly affected thin-wall casting fill. Filters offer less turbulent, steadier flow, which is appropriate for thicker castings, but they do not enhance thin-wall casting fill.

NTIS

*Cast Alloys; Thin Walls; Steels; Heat Transfer; Thickness*

## NONMETALLIC MATERIALS

*Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials. For composite materials see 24 Composite Materials.*

**20030014976** NASA Langley Research Center, Hampton, VA USA

**Diffusion Time-Scale of Porous Pressure-Sensitive Paint**

Liu, Tianshu, NASA Langley Research Center, USA; Teduka, Norikazu, Tokyo Univ. of Agriculture and Technology, Japan; Kameda, Masaharu, Tokyo Univ. of Agriculture and Technology, Japan; Asai, Keisuke, National Aerospace Lab., Japan; AIAA Journal; [2001]; Volume 39, No. 12, pp. 2400-2402; In English; Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche; Distribution as joint owner in the copyright; Distribution as joint owner in the copyright

Pressure-sensitive paint (PSP) is an optical pressure sensor that utilizes the oxygen quenching of luminescence. PSP measurements in unsteady aerodynamic flows require fast time response of the paint. There are two characteristic time-scales that are related to the time response of PSP. One is the luminescent lifetime representing an intrinsic physical limit for the achievable temporal resolution of PSP. Another is the time-scale of oxygen diffusion across the PSP layer. When the time-scale of oxygen diffusion is much larger than the luminescent lifetime, the time response of PSP is controlled by oxygen diffusion. In a thin homogenous polymer layer where diffusion is Fickian, the oxygen concentration 1021 can be described by the diffusion equation in one-dimension.

Derived from text

*Time Domain Analysis; Porosity; Pressure Sensitive Paints; Diffusion*

**20030015198** NASA Langley Research Center, Hampton, VA USA

**Tensile Properties of Hydrogels and of Snake Skin**

Hinkley, Jeffrey A., NASA Langley Research Center, USA; Savitzky, Alan H., Old Dominion Univ., USA; Rivera, Gabriel, Old Dominion Univ., USA; Gehrke, Stevin H., Kansas State Univ., USA; [2002]; 6p; In English; 1st World Congress on Biomim. and Artificial Muscles, 9-11 Dec. 2002, Albuquerque, NM, USA; Original contains color illustrations; Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche; Distribution as joint owner in the copyright; Distribution as joint owner in the copyright

Stimulus-responsive or 'smart' gels are of potential interest as sensors and actuators, in industrial separations, and as permeable delivery systems. In most applications, a certain degree of mechanical strength and toughness will be required, yet the large-strain behavior of gels has not been widely reported. Some exceptions include work on gelatin and other food gels, some characterization of soft gels applicable for in-vitro cell growth studies, and toughness determinations on commercial contact lens materials. In general, it can be anticipated that the gel stiffness will increase with increasing degree of crosslinking, but the tensile strength may go through a maximum. Gel properties can be tailored by varying not only the degree of crosslinking, but also the polymer concentration and the nature of the polymer backbone (e.g. its stiffness or solubility). Polypeptides provide an especially interesting case, where secondary structure affects trends in moduli and conformational transitions may accompany phase changes. A few papers on the tensile properties of responsive gels have begun to appear. The responsive hydrogel chosen for the present study, crosslinked hydroxypropylcellulose, shrinks over a rather narrow temperature range near 44 C. Some vertebrate skin is also subject to substantial strain. Among reptiles, the morphologies of the skin and scales show wide variations. Bauer et al. described the mechanical properties and histology of gecko skin; longitudinal tensile properties of snake skin were examined by Jayne with reference to locomotion. The present measurements focus on adaptations related to feeding, including the response of the skin to circumferential tension. Tensile properties will be related to interspecific and regional variation in skin structure and folding.

Author

*Tensile Properties; Gels; Snakes; Skin (Anatomy); Smart Materials; Actuators; Tensile Tests*

**20030015394** Air Force Research Lab., Propulsion Directorate West, Edwards AFB, CA USA

**Thermoplastics Modified with Nanoscale Inorganic Macromers**

Haddad, Timothy S.; Mather, Patrick T.; Jeon, Hong G.; Romo-Uribe, Angel; Farris, Amy R.; May 26, 1998; 8p; In English Report No.(s): AD-A409391; AFRL-PR-ED-TP-1998-087; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

We have taken a unique approach to the synthesis and study of hybrid organic/inorganic materials. Our method involves synthesizing nano-size inorganic P(10)R(7)Si(8)O(12) clusters which contain seven inert 'R' groups for solubility and only one functional 'P' group for polymerization. This strategy permits the synthesis of melt processable, linear hybrid polymers containing pendent inorganic clusters and allows us to study the effect these clusters have on chain motions and polymer properties. The synthesis of norbornenyl-based polyhedral oligomeric silsesquioxane (POSS) macromers, their ring opening metathesis

copolymerizations with varying amounts of norbornene, and analysis of the effect of the pendent POSS group is presented. The mechanical relaxation behavior and microstructure of norbornyl-POSS hybrid copolymers have been examined for their dependencies on the mole fraction of POSS-norbornyl monomer, as well as for potential sensitivity to the seven inert 'R' groups present in each POSS macromer. POSS copolymerization is observed to enhance the  $\alpha$ -relaxation temperature,  $T(\alpha)$  in proportion to the mole fraction of POSS-norbornyl comonomer. Interestingly, however, the magnitude of this dependence is larger for POSS-norbornyl comonomer possessing cyclohexyl groups (CyPOSS) than for cyclopentyl groups (CpPOSS). While POSS copolymerization yields only slight enhancement of the tensile storage modulus measured near room temperature at temperatures lower than a strong mechanical relaxation ( $\beta$ -relaxation near  $T = -75$  degrees C), there is a significant POSS-reinforcement of the storage modulus.

DTIC

*Copolymers; Synthesis (Chemistry)*

**20030015761** NASA Glenn Research Center, Cleveland, OH USA

**Polyesters by Photochemical Cyclopolymerization**

Meador, Michael A., Inventor, NASA Glenn Research Center, USA; Nov. 26, 2002; 9p; In English

Patent Info.: Filed 5 Apr. 2001; NASA-Case-LEW-17133-2; US-Patent-6,486,230; US-Patent-Appl-SN-827089; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The polyesters of this invention are derived from a Diels-Alder cyclopolymerization of a photochemically generated bisdiene with dienophiles, such as di(acrylates), tri (acrylates), di(methacrylates), tri(methacrylates) and mixtures thereof with mono(methacrylates) or mono(acrylate) end-caps. Irradiation of one or more diketones produces two distinct hydroxy o-quinodimethane (photoenol) intermediates. These intermediates are trapped via a Diels-Alder cycloaddition with appropriate dienophiles, e.g., di(acrylates) to give the corresponding polyesters quantitative yields. When di(acrylates), tri(acrylates) and di and tri(methacrylates) or mixtures thereof with monoacrylate end-caps are used as the dienophile, the resulting polyesters have glass transition temperatures ( $T_g$ ) as high as 200 C. Polyesters films can be prepared by ultraviolet irradiation of high solids content varnishes of the monomers in a small amount of solvent, e.g., cyclohexanone, dimethyl formamide, N-methylpyrrolidone and the like. These polyesters, i.e. polyesters are characterized as having high glass transition temperatures, good mechanical properties and improved processing in the manufacture of composites, adhesives, electronic materials and films.

Official Gazette of the U.S. Patent and Trademark Office

*Cyclic Compounds; Photochemical Reactions; Polyesters; Polymerization*

**20030015814** Air Force Research Lab., Space and Missile Propulsion Div., Edwards AFB, CA USA

**Hybrid POSS Polymer Technology for Rocket & Space Applications**

Phillips, Shawn H.; Nov. 30, 1999; 26p; In English

Contract(s)/Grant(s): Proj-1011

Report No.(s): AD-A409460; AFRL-PR-ED-TP-1999-0229; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

These viewgraphs contain information on polymer technology for rocket and space applications.

DTIC

*Polymers; Spacecraft Equipment*

**20030015817** Air Force Research Lab., Space and Missile Propulsion Div., Edwards AFB, CA USA

**In-Situ Oxygen-Atom Erosion Study of a Polyhedral Oligomeric Silsesquioxane (POSS)-Siloxane Copolymer Using a Novel Hyperthermal Oxygen Atom Source and Analysis by X-Ray Photoelectron Spectroscopy**

Gonzalez, Rene I.; Phillips, Shawn H.; Hoflund, Gar B.; Sep. 08, 1999; 26p; In English; Prepared in collaboration with University of Florida, Dept. of Chemical Engineering, Gainesville, FL

Contract(s)/Grant(s): Proj-2303

Report No.(s): AD-A409463; AFRL-PR-ED-TP-FY99-0179; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The surface of a film of a polyhedral oligomeric silsesquioxane (POSS)-siloxane copolymer has been characterized in-situ using X-ray photoelectron spectroscopy (XPS) before and after exposure to incremental fluences of oxygen atoms produced by a novel hyperthermal oxygen atom source. The data indicate that the atomic oxygen initially attacks the cyclohexyl groups that surround the POSS cage resulting in the formation and desorption of CO(2) from the surface.

DTIC

*Copolymers; X Ray Spectroscopy*

**20030015828** Air Force Research Lab., Propulsion Directorate West, Edwards AFB, CA USA

**Mechanical Relaxation and Microstructure of Poly(norbornyl-POSS) copolymers**

Mather, Patrick T.; Jeon, Hong G.; Romo-Uribe, A.; Haddad, Timothy S.; Lichtenhan, Joseph D.; Aug. 11, 1998; 38p; In English  
Contract(s)/Grant(s): AF Proj. 2303

Report No.(s): AD-A409490; AFRL-PR-ED-TP-1998-164; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The mechanical relaxation behavior and microstructure of a series of novel norbornyl-POSS organic-inorganic copolymers have been investigated. Furthermore, we examined the influence of weight fraction of POSS-norbornyl monomer, as well as the potential sensitivity to the seven organic corner groups present in each POSS macromer. POSS refers to the Polyhedral Oligomeric Silsesquioxane inorganic/organic macromer, which is composed of an inorganic Si<sub>8</sub>O<sub>12</sub> spherical core surrounded with seven inert organic corner groups and one reactive norbornyl moiety. It was observed that POSS copolymerization enhances the alpha-relaxation temperature, T<sub>sub alpha</sub>, however, the magnitude of this dependence is larger for the POSS-norbornyl comonomer possessing cyclohexyl corner groups (cyPOSS) than for the copolymer with cyclopentyl corner groups (cpPOSS).  
DTIC

*Copolymerization; Copolymers; Microstructure; Relaxation (Mechanics); Organic Chemistry*

**20030015842** Air Force Research Lab., Propulsion Directorate West, Edwards AFB, CA USA

**Hybrid Inorganic/Organic Diblock Copolymers. Nanostructure in Polyhedral Oligomeric Silsesquioxane Polymorborennes**

Haddad, Timothy S.; Mather, Patrick T.; Jeon, Hong G.; Chun, Seung B.; Phillips, Shawn H.; May 05, 2000; 7p; In English; Prepared in collaboration with ERC Corp., Edwards AFB, CA, Institute of Materials Science, University of Connecticut, CT, and  
Contract(s)/Grant(s): AF Proj. 2303

Report No.(s): AD-A409526; AFRL-PR-ED-TP-2000-107; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Our main approach to the synthesis and study of hybrid organic/inorganic materials involves incorporating nano-size inorganic polyhedral oligomeric silsesquioxane (POSS) clusters into various polymeric resins. A typical POSS cluster is a discrete silicon and oxygen framework solubilize with organic groups and contains a single reactive site. This lone site of reactivity is used to covalently attach the inorganic macromers pendent to a polymer backbone without causing any crosslinking. This strategy permits the synthesis of melt processable, linear hybrid polymers containing pendent inorganic clusters, and allows us to study the effect these clusters have on chain motion, polymer properties and morphology. The synthesis of norbornenyl-based (POSS) macromers, their ring opening metathesis copolymerizations with varying amounts of norbornene, and analysis of the effect of the pendent POSS group is presented. Ring opening metathesis polymerization permits the easy synthesis of both random and diblock copolymers. Transmission electron microscopy (TEM) clearly images POSS-rich domains against the POSS- free regions. Major differences in polymer morphology are observed as the amount of inorganic POSS is varied, between random and diblock copolymers, as well as between polymers that differ only in the solubilizing cycloalkyl groups on the POSS cluster.

DTIC

*Copolymerization; Block Copolymers; Synthesis (Chemistry); Silicon Compounds; Resins; Nanostructure (Characteristics)*

**20030015846** Air Force Research Lab., Propulsion Directorate West, Edwards AFB, CA USA

**New Insight into the Structure-Property Relationships of Hybrid (Inorganic/Organic) POSS Thermoplastics**

Phillips, Shawn H.; Blanski, Rusty L.; Svejda, Steven A.; Haddad, Timothy S.; Lee, Andre; Apr. 17, 2000; 12p; In English; Pres: Materials Research Society Meeting, 24 Apr-2 May 2000, San Francisco, CA

Contract(s)/Grant(s): AF Proj. 2303

Report No.(s): AD-A409531; AFRL-PR-ED-TP-2000-072; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The demand for multi-purpose, high-performance polymer systems has resulted in a need for advancing polymer properties beyond what traditional systems can offer. Only through control/alteration at the molecular level can one maximize property enhancements to meet current military and commercial needs. Over the last seven years the Air Force Research Laboratory has developed and incorporated discrete Si-O frameworks (POSS = Polyhedral Oligomeric Silsesquioxanes) into traditional organic polymer systems. This research has resulted in new hybrid inorganic-organic polymer systems with remarkable enhancements in mechanical and physical properties including dramatic increases in both glass transition and decomposition temperatures, reduced flammability, increased moduli and oxidation resistance. We have shown that these enhancements result from the chemical composition (Si-O core) and size (<sup>^</sup>15 A in diameter) of the POSS frameworks, and can be copolymerized, grafted, or even blended using traditional processing methods. Recently, we have focused our efforts on understanding and controlling the molecular level interactions between POSS frameworks and the polymer matrix. The development of new POSS monomers has allowed us to study how functionality, size, and geometry enhances the bulk properties of these hybrid materials. For example, increasing the solubility of side groups on the POSS framework results in greater POSS-polymer matrix interactions and increased

Tg and storage moduli. Recent studies with POSS blends have resulted in increases in hardness, and reductions in dielectric constants and coefficients of thermal expansion. New results in polymer synthesis, characterization, and applications will be discussed with a strong emphasis on the versatility of this new nanotechnology to many polymer systems.

DTIC

*Copolymers; Thermoplastic Resins; Synthesis (Chemistry); Hybrid Structures; Mechanical Properties*

**20030018257** Osaka City Univ., Div. of Civil Engineering, Japan

**Influence of Quality of Recycled Fine Aggregate on Properties of Concrete**

Fumoto, Takayuki, Osaka City Univ., Japan; Yamada, Masaru, Osaka City Univ., Japan; *Memoirs of the Faculty of Engineering, Osaka City University*; December 2002; ISSN 0078-6659; Volume 43, pp. 97-103; In English; Copyright; Avail: Issuing Activity

Today, the river sand isn't gathered because of the destruction of the environment. So recycled aggregates hopes to use for concrete. But properties of concrete with recycled aggregate are decreased by qualities of one. Then the concrete properties need to be estimated by some indexes including the aggregate qualities. In this study, when 6 sorts of fine aggregate were used, we investigated influences of qualities of fine aggregate on properties of fresh and hardened concrete. As the result, it was found that, for the case of same mix proportions, the air content was decreased with increase of the total surface area of fine aggregate and the slump was decreased for the reason. And if total water content was made water content added to the amount of absorbed water of all aggregates, concrete strengths were correlated with cement content to total water content ratio. It will be able to use as a index for controlling concrete strengths.

Author

*Aggregates; Moisture Content; Cements; Estimating*

**20030018261** Osaka City Univ., Dept. of Physical Electronics and Information, Japan

**Diffusion of ZnS:Mn Active Layer to Plasma Polymerized p-xylene Thin Film**

Taniguchi, Akifumi, Osaka City Univ., Japan; Nara, Atushi, Hosiden Corp., Japan; Tanaka, Kenji, Osaka City Univ., Japan; Aozasa, Masao, Osaka City Univ., Japan; *Memoirs of the Faculty of Engineering, Osaka City University*; December 2002; ISSN 0078-6659; Volume 43, pp. 7-11; In English; Copyright; Avail: Issuing Activity

As a preliminary work to fabricate an organic and inorganic compound EL device, we investigated diffusion across two layers by annealing. p-xylene was plasma polymerized on ZnS:Mn film deposited by the sputtering method. The diffusion is enhanced as the annealing time and temperature increases. and the previous annealing effectively suppresses the diffusion of inorganic material afterward.

Author

*Polymerization; Plasmas (Physics); Diffusion; Zinc Sulfides; Thin Films; Xylene*

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### PROPELLANTS AND FUELS

*Includes rocket propellants, igniters and oxidizers; their storage and handling procedures; and aircraft fuels. For nuclear fuels see 73 Nuclear Physics. For related information see also 07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, and 44 Energy Production and Conversion.*

**20030014751** Environmental Protection Agency, Office of Atmospheric Programs, Washington, DC USA

**Quality Assurance/Quality Control and Uncertainty Management Plan for the U.S. Greenhouse Gas Inventory: Procedures Manual for Quality Assurance/Quality Control and Uncertainty Analysis**

Jun. 2002; 154p; In English

Report No.(s): PB2003-102527; EPA/430/R-02/007B; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

Each year, the U.S. Environmental Protection Agency (EPA), in cooperation with other federal agencies, prepares an Inventory of U.S. Greenhouse Gas Emissions and Sinks (here referred to as the Inventory). The emission estimates, trends, and other results of the inventory are used for a variety of purposes, including monitoring and tracking the progress of the USA in meeting commitments under the United Nations Framework Convention on Climate Change (UNFCCC). The USA has developed a comprehensive approach to preparing the inventory and the associated official documentation and communications that accompany and report the estimates. One of the primary goals of the U.S. Greenhouse Gas Inventory Program is to work continually to improve emission estimates. to this end, the U.S. inventory program has adopted a comprehensive and unified approach to managing quality and uncertainty in the inventory estimates. The philosophy underlying the approach is that methodological advances, improvements in documentation and clarity to facilitate transparency, quality control and quality

assurance, and uncertainty analysis should all be integrated into one comprehensive greenhouse gas inventory system. This document is one of two complementary documents that together describe and provide guidance on the overall process of preparing, submitting, and disseminating a greenhouse gas inventory that has undergone quality control (QC) and quality assurance (QA) procedures.

NTIS

*Greenhouse Effect; Air Pollution; Emission; Inventories; Management Planning; USA; Environment Protection; Quality Control*

**20030014752** Environmental Protection Agency, Office of Atmospheric Programs, Washington, DC USA

**Quality Assurance/Quality Control and Uncertainty Management Plan for the U.S. Greenhouse Gas Inventory: Background on the U.S. Greenhouse Gas Inventory Process**

Jun. 2002; 38p; In English

Report No.(s): PB2003-102524; EPA/430/R-02/007A; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The inventory serves a number of purposes, foremost of which is fulfilling our international commitments to report under the United Nations Framework Convention on Climate Change (UNFCCC). In addition to satisfying this formal commitment, the inventory data are critical to monitoring and tracking the progress of the USA in meeting commitments under the UNFCCC. The preparation of the greenhouse gas inventory is also part of a broader program of technical and policy support, and contributes to technical, scientific, and policy research aimed at understanding the relative contribution of different emission sources and sinks to overall emissions, the future time path of emissions and atmospheric greenhouse gas concentrations, and the potential cost of limiting emissions from different gases and sources. The inventory program also focuses on improving methodologies, on developing estimates for new source categories, and on finding new and improved activity data, emission factors, and direct measurements that go into the process of estimating the inventory.

NTIS

*Greenhouse Effect; Air Pollution; Inventories; Management Planning*

**20030014753** Environmental Protection Agency, Washington, DC USA

**Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2000**

Apr. 15, 2002; In English

Report No.(s): PB2003-102522; EPA/430/R-02/003; No Copyright; Avail: CASI; C01, CD-ROM

Central to any study of climate change is the development of an emissions inventory that identifies and quantifies a country's primary anthropogenic sources and sinks of greenhouse gases. This inventory adheres to both (1) a comprehensive and detailed methodology for estimating sources and sinks of anthropogenic greenhouse gases, and (2) a common and consistent mechanism that enables signatory countries to the United Nations Framework Convention on Climate Change (UNFCCC) to compare the relative contribution of different emission sources and greenhouse gases to climate change. Moreover, systematically and consistently estimating national and international emissions is a prerequisite for accounting for reductions and evaluating mitigation strategies.

NTIS

*Greenhouse Effect; Air Pollution; Contaminants; Climate Change; Sinks; Emission; Inventories*

**20030014893** Chemical Compliance Systems, Inc., Lake Hopatcong, NJ USA

**Insensitive Munitions Analytical Compliance System (I-MACS) Concept**

Thompson, George R., Chemical Compliance Systems, Inc., USA; Nordquist, Tyrone D., Army Defense Ammunition Center, USA; 20th JANNAF Propulsion Systems Hazards Subcommittee Meeting; April 2002; Volume 1, pp. 15-33; In English; Also announced as 20030014891; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200  
HC

Contents include the following: Munitions Compliance and Analytical System. Hazardous Munition Components, Parts and Constituents. Munitions Life Cycle Unplanned Stimuli. Insensitive Munitions System Requirements. Incompatible Chemical Database. Constituent Analogous Criteria Database. Test Plane Status and Results

CASI

*Data Bases; Analyzing; Armor*

**20030014894** North Atlantic Treaty Organization, NATO Insensitive Munitions Information Center, Brussels, Belgium

**Recent NIMIC Workshops and Technical Activities**

Fisher, M. J., North Atlantic Treaty Organization, Belgium; 20th JANNAF Propulsion Systems Hazards Subcommittee Meeting; April 2002; Volume 1, pp. 35-46; In English; Also announced as 20030014891; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC

Between November 2000 and June 2001, the NATO Insensitive Munitions Information Center (NIMIC) sponsored a two-part workshop entitled Assessing the Risk and the Cost Benefits associated with the Introduction of IM. The first part, dedicated to risk issues, aimed to identify a method of assessing the potential reduction in risk associated with the insertion of IM technology, or the transition from conventional (non-IM) munitions to IM compliant ones. The aim of part two of the workshop was to establish a methodology to assess the costs and associated benefits for each stage of the life cycle of an IM compliant munition in an existing or new weapon system. This document highlights the activities, conclusions and recommendations of this two-part workshop, and discusses follow-on activities. The results of a third NIMIC workshop, dealing with IM Assessment Methodology, are also presented. The goal of this workshop was to develop a methodology, including process flowcharts linked to phases of the munition acquisition program, for planning, conducting and documenting a complete and useful IM assessment. It is NIMIC's intent that the resulting methodology be used as the basis for a new edition of AOP-39, the guidance document supporting the IM STANAG. A brief synopsis of other current NIMIC activities (e.g., a survey and analysis of Fragment Impact testing methods, the Cost Benefit Analysis Modeling tool (CBAM), the IM State-of-the-Art database, and the Composite Case Technology Review) is also included.

Author

*Weapon Systems; Project Planning; Life (Durability); Impact Tests; Cost Analysis*

**20030014897** Naval Air Warfare Center, Weapons Div., China Lake, CA USA

**Standardization of the Ballistic Impact Chamber Test**

Woody, Diana L., Naval Air Warfare Center, USA; Davis, Jeffery J., Naval Air Warfare Center, USA; 20th JANNAF Propulsion Systems Hazards Subcommittee Meeting; April 2002; Volume 1, pp. 107-109; In English; Also announced as 20030014891; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC

The Ballistic Impact Chamber (BIC) test is a small-scale instrumented test capable of measuring sensitivity and energy/gram output. It does so by measuring the initial rate of reaction, time of reaction, and the energy output during the impact of the energetic material.

Author

*Standardization; Impact Tests; Ballistic Cameras; Test Chambers*

**20030014898** Sandia National Labs., Combustion Research Facility, Livermore, CA USA

**Development of a Physicochemical Model for the Thermal Decomposition of RDX**

Maharrey, Sean, Sandia National Labs., USA; Wiese-Smith, Deneille, Sandia National Labs., USA; Behrens, Richard, Sandia National Labs., USA; 20th JANNAF Propulsion Systems Hazards Subcommittee Meeting; April 2002; Volume 1, pp. 111-124; In English; Also announced as 20030014891

Contract(s)/Grant(s): ARO-38302-CH; DE-AC04-94AL-85000; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC

Simultaneous thermogravimetric modulated beam mass spectrometry (STMBMS), optical microscopy, and scanning electron microscopy (SEM) have been used to study the physical and chemical processes that control the thermal decomposition of RDX. Results indicate that there is a complex set of parallel processes that control the decomposition. The extent of confinement of the gaseous decomposition products with the remaining RDX varies the relative importance of these parallel pathways. The decomposition of RDX has been studied over the temperature range from 160 to 215 C. A nucleation process involving the growth of a non-volatile residue (NVR) among the RDX particles controls the rate of the solid-phase decomposition reaction, and although the late stage NVR process is now also observed in the liquid-phase decomposition, its mechanism of development during the course of the decomposition reaction is currently unknown. Once the NVR has formed, the interactions between RDX/mononitroso-RDX/gas-phase decomposition products with the NVR become the dominant reaction pathway in the solid-phase and an important parallel pathway in the liquid-phase decomposition. During this interaction, the main gas products evolved are H<sub>2</sub>O, CO/N<sub>2</sub>, CH<sub>2</sub>O, NO, and N<sub>2</sub>O. Decomposition of the NVR is also observed and results in the evolution of more complex gas products than are observed in the RDX decomposition. These NVR decomposition products include: N-methylformamide, N,N-dimethylformamide, dimethylnitrosamine and C<sub>3</sub>H<sub>9</sub>N (a form of amine). We observe acceleration in the initial rate (just after melting) of a liquid-phase decomposition with addition of NVR from a previous solid or liquid-phase experiment, indicating that liquefaction of RDX by the NVR is not uniquely responsible for the observed autocatalytic effect.

These RDX/NVR decomposition processes are coupled with previously developed processes covering the liquid-phase thermal decomposition of RDX under lower gas confinement, where the NVR process does not fully develop. Mathematical models characterizing these processes are under development. The parameters for these decomposition models are being determined from the STMBMS, optical micrograph, and SEM data.

Author

*Thermal Decomposition; Chemical Reactions; Liquefaction; Melting; Models; Nitrogen Oxides; Nucleation; RDX*

**20030014899** Los Alamos National Lab., NM USA

**A Model of Thermal Decomposition and Ignition in HMX**

Henson, Bryan F., Los Alamos National Lab., USA; Smilowitz, Laura, Los Alamos National Lab., USA; Asay, Blaine W., Los Alamos National Lab., USA; Dickson, Peter M., Los Alamos National Lab., USA; 20th JANNAF Propulsion Systems Hazards Subcommittee Meeting; April 2002; Volume 1, pp. 125-133; In English; Also announced as 20030014891; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC

We present a global chemical decomposition model for HMX based materials and discuss its application to questions concerning the evolution of explosive morphology during thermal decomposition and the prediction of energy release subsequent to ignition. The model contains three component processes, the initial beta to delta phase transition, solid to gas decomposition and gas phase ignition, for which all kinetic and thermodynamic parameters are fixed by independent measurement. We present a very simple isothermal ignition calculation over the range of temperatures from thermal explosion to detonation. The calculation is performed for a sphere of material and the critical diameter and time for ignition are determined. The sample diameter, and thus the balance of heat generation and dissipation, is the only degree of freedom in the calculation. The results of the calculation are in good agreement with data with respect to both the ignition times and length scales over the full temperature range of energetic response in HMX. We discuss this particular success of the model as an indication that key components of the process of decomposition and ignition are in place. We also discuss details of the current model which will be insufficient to capture essential features of the decomposition, principally the physical and structural evolution of the material during heating. Finally we discuss how these features may be incorporated into the model, and how these features will provide additional detail in understanding the state of the material at ignition and consequent energy release.

Author

*Thermal Decomposition; Models; Ignition; Vapor Phases; Morphology; HMX; Explosions*

**20030014900** Sandia National Labs., Combustion Research Facility, Livermore, CA USA

**Thermal Decomposition of HMX: Morphological and Chemical Changes Induced at Slow Decomposition Rates**

Behrens, Richard, Sandia National Labs., USA; 20th JANNAF Propulsion Systems Hazards Subcommittee Meeting; April 2002; Volume 1, pp. 135-146; In English; Also announced as 20030014891  
Contract(s)/Grant(s): DE-AC04-94AL-85000; ARO-38302-CH; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC

An overview of the chemical and physical processes that occur during the thermal decomposition of HMX at temperatures below its melting point (approx. 270 C) is presented. Reactions in the gas, solid and molten phases all contribute to the overall decomposition process. As HMX is heated and it begins to decompose, morphological changes occur in the solid particles. The B->O phase transition creates a grain structure within the particles and causes cracking. In addition, nucleation and growth of reaction regions within the grains leads to the formation of bubbles filled with gaseous decomposition products and a nonvolatile residue (NVR). The types of chemical reactions that control the decomposition include unimolecular decomposition reactions, bimolecular reactions with the gaseous decomposition products and reactions with the NVR. Reactions with the NVR occur at interfacial boundaries associated with the bubbles and grain boundaries. Thus, the changing morphological features of the sample play an important role in its rate of decomposition. A qualitative model of these overall processes and the development of a new reaction modeling kinetics compiler and analysis tool are presented.

Author

*Thermal Decomposition; HMX; Morphology; Chemical Reactions; Reaction Kinetics; Phase Transformations*

**20030014901** Sandia National Labs., Albuquerque, NM USA

**Real-Time Ultrasonic Characterization of Thermally-Damaged Energetic Materials Approaching Cookoff**

Tappan, A. S., Sandia National Labs., USA; Renlund, A. M., Sandia National Labs., USA; Miller, J. C., Sandia National Labs., USA; Casstevens, J. E., Sandia National Labs., USA; Oliver, M. S., Sandia National Labs., USA; 20th JANNAF Propulsion Systems Hazards Subcommittee Meeting; April 2002; Volume 1, pp. 147-153; In English; Also announced as 20030014891

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Understanding the physical properties of thermally-damaged energetic materials in cookoff scenarios is vital to developing and validating predictive codes to describe ignition and post-ignition behavior. We report work in progress on a small-scale experiment, called the "ultrasonic hot cell" to determine how certain physical properties of energetic materials change as thermal damage evolves. The experiment involves the controlled heating of a 6.35-mm-diameter cylindrical energetic material sample within rigid radial confinement. Moveable pistons provide the axial confinement on the sample, which is measured by a load cell and LVDT extensometer and feed back-controlled by means of a pneumatic cylinder. Ultrasonic time-of-flight measurements are taken and combined with LVDT length measurements to measure the ultrasonic velocity as the material decomposes. By combining data from shear and longitudinal ultrasonic experiments, the real-time elastic moduli of thermally-degraded HMX (1,3,5,7-tetranitro-1,3,5,7-tetraazacyclooctane) and PBX-9501 (95% HMX, 2.5% Estane, 2.5% BDNPA-F (bis(2,2-dinitropropyl) acetal/formal)), at several, constant axial force loads are measured. The effect of heating on Composition B (60% RDX (hexahydro-1,3,5-trinitro-1,3,5-triazine), 40% TNT (trinitrotoluene)) is also examined.

Author

*Real Time Operation; Ultrasonic Spectroscopy; Cylindrical Bodies; Damage; Extensometers; Firing (Igniting); Temperature Effects*

**20030014902** Los Alamos National Lab., NM USA

#### **Measurement of Gas Permeability of Thermal Damaged PBX 9501**

Asay, B. W., Los Alamos National Lab., USA; Schaefer, T., Los Alamos National Lab., USA; Dickson, P., Los Alamos National Lab., USA; Henson, B., Los Alamos National Lab., USA; Smilowitz, L., Los Alamos National Lab., USA; 20th JANNAF Propulsion Systems Hazards Subcommittee Meeting; April 2002; Volume 1, pp. 155-161; In English; Also announced as 20030014891; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC

We have constructed a gas permeameter to measure the permeability of explosives that have been thermally damaged. We report on the calibration of the instrument as well as initial measurements of the permeability of pristine and damaged PBX 9501. We are beginning a program that will provide detailed static and dynamic permeability measurements on a range of explosives under different conditions. These data are essential if adequate predictions of ignition and violence in cookoff are to be obtained.

Author

*Permeability; Measuring Instruments; Ignition; Calibrating*

**20030014903** Lawrence Livermore National Lab., Livermore, CA USA

#### **Deflagration Behavior of PBXN-109 and Composition B at High Pressures and Temperatures**

Maienschein, Jon L., Lawrence Livermore National Lab., USA; Wardell, Jeffrey F., Lawrence Livermore National Lab., USA; 20th JANNAF Propulsion Systems Hazards Subcommittee Meeting; April 2002; Volume 1, pp. 163-171; In English; Also announced as 20030014891

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We report deflagration rate measurements on PBXN-109 (RDX/Al/HTPB) and Composition B (RDX/TNT/wax) at pressures from 1,500 - 100,000 psi (10-700 MPa). This was done with the LLNL High Pressure Strand Burner, in which embedded wires are used to record the time-of-arrival of the burn front in the cylindrical sample as a function of pressure. The propellant samples are 6.4 mm in diameter and 6.4 mm long, with burn wires inserted between samples. Burning on the cylindrical surface is inhibited with an epoxy or polyurethane layer. With this direct measurement we do not have to account for product gas equation of state or heat losses in the system, and the burn wires allow detection of irregular burning. We report deflagration results for PBXN-109 as received, and also after it has been damaged by heating. The burn behavior of pristine PBXN-109 is very regular, and exhibits a reduction in pressure exponent from 1.32 to 0.85 at pressures above 20,000 psi (135 MPa). When PBXN-109 is thermally damaged by heating to 170-180 C, the deflagration rate is increased by more than a factor of 10. This appears to be a physical effect, as the faster burning may be explained by an increase in surface area. Our results with Composition B show an apparent 2nd order pressure dependence for initial deflagration, followed by deconsolidation and onset of very rapid and erratic burning. The deconsolidation may be the result of the TNT melting as heat flows into the sample.

Author

*Combustion; Deflagration; Heat Transfer; HTPB Propellants; RDX*

**20030014904** Naval Air Warfare Center, Research Development, China Lake, CA USA

**Experimental Progress on a Cookoff Model Validation Effort**

Atwood, A. I., Naval Air Warfare Center, USA; Curran, P. O., Naval Air Warfare Center, USA; Lee, K. B., Naval Air Warfare Center, USA; 20th JANNAF Propulsion Systems Hazards Subcommittee Meeting; April 2002; Volume 1, pp. 173-191; In English; Also announced as 20030014891; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC

Small-scale cookoff validation experiments have been performed with two types of steel tube confinement. Internal thermocouple measurements were made in a test of PBXN-109. The HMX based explosives, LX-10 and PBX-9501 were incorporated into the Phase 11 effort in order to demonstrate increased cookoff reaction violence. A quantification of early reaction violence was made using the results of maximum strain rate measured during the cookoff event.

Author

*Steels; Confinement; Experimentation; HMX; Firing (Igniting)*

**20030014905** Naval Sea Systems Command, Dept. of Research and Technology, Indian Head, MD USA

**Validation Experiments for Slow Cook-Off**

Sandusky, Harold W., Naval Sea Systems Command, USA; Chambers, G. Paul, Naval Sea Systems Command, USA; 20th JANNAF Propulsion Systems Hazards Subcommittee Meeting; April 2002; Volume 1, pp. 193-199; In English; Also announced as 20030014891; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC

Slow cook-off experiments are being conducted with measurements of temperature, pressure, and volume until the onset of reaction; and measurements of case velocity and blast overpressure during reaction. The goal is to relate changes in the energetic material during heating with time and position for onset of reaction plus reaction violence as a function of sample size, confinement, gas sealing, and heating profile. An apparatus in which the sample is confined by spring-loaded rams in a heated cylinder has been evaluated, both experimentally and computationally, with inert samples of Teflon. Experiments have been conducted on the RDX-based explosive PBXN-109 and on the HMX-based explosive PBXN-5. This effort is in conjunction with characterization and cook-off experiments in cylinders with fixed ends at the Naval Air Warfare Center/China Lake, and other characterization measurements as well as modeling at the Lawrence Livermore and Sandia National Laboratories.

Author

*Confinement; Firing (Igniting); Gas Heating; HMX; Temperature Measurement*

**20030014906** Sandia National Labs., Albuquerque, NM USA

**Cook-Off Experiments for Model Validation**

Kaneshige, M. J., Sandia National Labs., USA; Renlund, A. M., Sandia National Labs., USA; Schmitt, R. G., Sandia National Labs., USA; Erikson, W. W., Sandia National Labs., USA; 20th JANNAF Propulsion Systems Hazards Subcommittee Meeting; April 2002; Volume 1, pp. 201-209; In English; Also announced as 20030014891  
Contract(s)/Grant(s): DE-AC04-94AL-85000; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC

A series of experiments has been started at Sandia National Laboratories to observe details of the ignition process during cook-off of energetic materials. Issues such as the location of ignition, size of the ignition region, and heating rates prior to ignition are of great importance to our ability to model cook-off accurately, beyond time-to-ignition curve fits. We are approaching this problem with an apparatus consisting of a thermocouple grid placed between two samples of energetic material encased in a sealed aluminum block with external heating. Data from these experiments will be useful for advancing the thermochemical models used to predict cook-off ignition. Two experiments and their results are described, and suggest that sealing and the amount of time spent at elevated temperature may have important effects on the ignition process and the resulting violence of reaction.

Author

*Time Temperature Parameter; Thermochemical Properties; High Temperature; Firing (Igniting)*

**20030014907** Lawrence Livermore National Lab., Livermore, CA USA

**Thermal Explosion Violence of HMX-Based and RDX-Based Explosives: Effects of Composition, Confinement, and Solid Phase Using the Scaled Thermal Explosion Experiment**

Maienschein, Jon L., Lawrence Livermore National Lab., USA; Wardell, Jeffrey F., Lawrence Livermore National Lab., USA; 20th JANNAF Propulsion Systems Hazards Subcommittee Meeting; April 2002; Volume 1, pp. 211-220; In English; Also announced as 20030014891

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The Scaled Thermal Explosion Experiment (STEX) has been developed to quantify the violence of thermal explosion under well defined and carefully controlled initial and boundary conditions. Here we present results with HMX-based explosives (LX-04 and PBX-9501) and with Composition B. Samples are 2 inches (50 mm) in diameter and 8 inches (200 mm) in length, under confinement of 7,500 - 30,000 psi (50-200 MPa), with heating rates of 1-3 C/hr. We quantify reaction violence by measuring the wall velocity in the ensuing thermal explosion, and relate the measured velocity to that expected from a detonation. Results with HMX-based explosives (LX-04 and PBX-9501) have shown the importance of confinement and HMX solid phase, with reaction violence ranging from mild pressure bursts to near detonations. by contrast, Composition B has shown very violent reactions over a wide range of conditions.

Author

*Thermal Emission; Explosions; Violence; HMX; RDX; Solid Phases*

**20030014908** Lawrence Livermore National Lab., Livermore, CA USA

**ALE3D Model Predictions and Materials Characterization for the Cookoff Response of PBXN-109**

McClelland, M. A., Lawrence Livermore National Lab., USA; Maienschein, J. L., Lawrence Livermore National Lab., USA; Nichols, A. L., Lawrence Livermore National Lab., USA; Wardell, J. F., Lawrence Livermore National Lab., USA; Atwood, A. I., Naval Air Warfare Center, USA; Curran, P. O., Naval Air Warfare Center, USA; 20th JANNAF Propulsion Systems Hazards Subcommittee Meeting; April 2002; Volume 1, pp. 221-235; In English; Also announced as 20030014891

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ALE3D simulations are presented for the thermal explosion of PBXN-109 (RDX, Al, HTPB, DOA) in support of an effort by the U. S. Navy and Department of Energy (DOE) to validate computational models. The U. S. Navy is performing benchmark tests for the slow cookoff of PBXN-109 in a sealed tube. Candidate models are being tested using the ALE3D code, which can simulate the coupled thermal, mechanical, and chemical behavior during heating, ignition, and explosion. The strength behavior of the solid constituents is represented by a Steinberg-Guinan model while polynomial and gamma-law expressions are used for the equation of state of the solid and gas species, respectively. A void model is employed to represent the air in gaps. ALE3D model parameters are specified using measurements of thermal and mechanical properties including thermal expansion, heat capacity, shear modulus, and bulk modulus. A standard three-step chemical kinetics model is used during the thermal ramp, and a pressure-dependent burn front model is employed during the rapid expansion. Parameters for the three-step kinetics model are specified using measurements of the One-Dimensional-Time-to-Explosion (ODTX), while measurements for burn rate of pristine and thermally damaged material are employed to determine parameters in the burn front model. Results are given for calculations in which heating, ignition, and explosion are modeled in a single simulation. We compare model results to measurements for the cookoff temperature and tube wall strain.

Author

*Burning Rate; Chemical Reactions; Explosions; Firing (Igniting); Heating; HTPB Propellants; Reaction Kinetics; Mathematical Models*

**20030014911** Naval Air Warfare Center, Weapons Div., China Lake, CA USA

**Convective Combustion Studies of Nitramine Based Explosives**

Atwood, A. I., Naval Air Warfare Center, USA; Curran, P. O., Naval Air Warfare Center, USA; Bui, D. T., Naval Air Warfare Center, USA; Lee, K. B., Agency for Defense Development, Korea, Republic of; 20th JANNAF Propulsion Systems Hazards Subcommittee Meeting; April 2002; Volume 1, pp. 255-267; In English; Also announced as 20030014891; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC

A convective combustion experiment is described that is being used to evaluate the response of the various nitramine based explosives to a thermal stimulus. The experiment was designed to allow for the comparison of both mechanically and thermally stimulated porous beds. Flame propagation and pressurization rates of Composition A-4, PBXN-5, HMX and CL-20 were measured. Initial bed density was a variable with tests performed at 74 and 97 percent TMD with the Composition A-4, 44 and 74 percent TMD in PBXN-5 and about 44 percent TMD in the CL-20 and HMX. DDT was observed in the firings of HMX and CL-20 with an intermediate reaction occurring in the low density PBXN-5 firing, Flame propagation rates were about half the rate of pressurization in the firing exhibiting convective combustion. Pressurization rates were beyond the frequency response of the pressure transducers used in the firings exhibiting DDT.

Author

*Convection; Combustion; Nitramine Propellants*

**20030014912** Naval Surface Warfare Center, Weapons Dept., Indian Head, MD USA

**Electrostatic Discharge Sensitivity Testing Revisited**

McCahill, Michael J., Naval Surface Warfare Center, USA; Lee, Richard J., Naval Surface Warfare Center, USA; Remmers, Daniel L., Naval Surface Warfare Center, USA; 20th JANNAF Propulsion Systems Hazards Subcommittee Meeting; April 2002; Volume 1, pp. 269-281; In English; Also announced as 20030014891; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC

A recent investigation of a perceived shift in electrostatic discharge (ESD) sensitivity in aging rocket propellant has again raised concerns over variability and meaningfulness of standard ESD testing. Measurements of energy delivered to various test samples were made as part of this investigation. These measurements demonstrated that the actual energy delivered to test samples is a fraction of that stored in the capacitor, and that the energy delivered can vary between trials. These observations indicate how the discharge circuit can provide misleading results. Additional errors may be made in attempting to determine a Go versus a No-Go event. At Naval Surface Warfare Center, Indian Head Division (IHDIV) this determination is currently made by the operator looking for a color change in the arc channel. Tests using Kapton backed tape over the sample holder were performed to see if the relative damage to the tape might prove to be a more satisfying indicator. This, again, did not always provide a result that was easily interpreted. Propellants provided varying damage to the tape proportional to the amount of energy delivered. Consolidated inert samples (with and without aluminum) provided significant damage to the tape when provided energies in the upper levels that the system provides.

Author

*Electrostatics; Disposal; Aging (Materials); Damage; Rocket Propellants; Sensitivity*

**20030014913** Naval Sea Systems Command, Research and Technology Dept., Indian Head, MD USA

**Review of Gap Tests**

Sandusky, Harold W., Naval Sea Systems Command, USA; 20th JANNAF Propulsion Systems Hazards Subcommittee Meeting; April 2002; Volume 1, pp. 283-295; In English; Also announced as 20030014891; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC

Since the last review of gap testing in 1980 Proceedings of the JANNAF Propulsion Systems Hazards Subcommittee meeting, more is understood from modeling the shock transmitted into the gap by the explosive donor, and tests with donors greater than the 2 in diameter of the NOL large scale gap test (LSGT) have been developed for examining energetic materials with larger critical diameters. In addition to these topics, the following are discussed: effects from changing the size and height-to-diameter ratio of the donor, the comparable shock loading profiles for cylindrical and conical donors, and the effect of sample confinement. Specific reference will be made to the NOL LSGT because of its wide usage and available documentation; however, the discussion applies to the various gap tests. It is recommended that the largest (8 in diameter) gap test not be substantially changed.

Author

*Propulsion System Performance; Cylindrical Bodies; Confinement*

**20030014914** Naval Air Warfare Center, Weapons Div., China Lake, CA USA

**Effect of Experiment's Configuration in Determination of Shock Sensitivity of Propellants**

Heimdahl, Olaf E. R., Naval Air Warfare Center, USA; Lindfors, Allen J., Naval Air Warfare Center, USA; Boggs, Thomas L., Naval Air Warfare Center, USA; Davis, Jeffery J., Naval Air Warfare Center, USA; 20th JANNAF Propulsion Systems Hazards Subcommittee Meeting; April 2002; Volume 1, pp. 297-305; In English; Also announced as 20030014891; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC

As part of our effort to design and validate a test procedure to determine the shock classification of rocket motor propellants, extensive computer modeling has been performed. This modeling has examined various experimental configurations to determine shock initiations in a gap test configuration. Design considerations that have been examined include shape and aspect ratio of booster and PMMA gap, as well as the effect of confinement of the propellant. DYNA-2D was used to design an experiment that could be easily performed by different services using commercially available materials and that would satisfy the need to determine 1.1 and 1.3 classification. The objective of this program is determination of shock classification of a propellant using a newly developed test methodology as an alternative to the Technical Bulletin 700-2 revised classification standards. The new test methodology uses more realistic confinement as well as smaller sample sizes. A goal is achieving fundamental understanding of the shock initiation and reaction in the propellant sample.

Author

*Computerized Simulation; Propellant Sensitivity; Rocket Engines; Shock Tests*

**20030014915** Naval Air Warfare Center, Weapons Div., China Lake, CA USA

**Determination of Shock Sensitivity of Propellants in Gap Test Configuration**

Lindfors, Allen J., Naval Air Warfare Center, USA; Heimdahl, Olaf E. R., Naval Air Warfare Center, USA; Boggs, Thomas L., Naval Air Warfare Center, USA; Davis, Jeffery J., Naval Air Warfare Center, USA; 20th JANNAF Propulsion Systems Hazards Subcommittee Meeting; April 2002; Volume 1, pp. 307-313; In English; Also announced as 20030014891; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC

The objective of this research is determination of shock classification of a propellant using a newly developed test methodology as an alternative to the Technical Bulletin 700-2 revised classification standards. The new test methodology uses more realistic confinement as well as smaller sample sizes. As part of our effort to design and validate a test procedure to determine the shock classification of rocket motor propellants, experiments are to be performed on a high-performance propellant. The experiment is based on modeling to determine an experimental configuration that satisfies concerns over 1.1 versus 1.3 classification. The gap test uses PVC pipe to confine the propellant in order to more accurately simulate an actual rocket case. PVC is commercially available making cost efficient duplication of the tests at sites around the nation.

Author

*Shock Tests; Propellant Sensitivity; Propellants; Confinement*

**20030015421** Illinois Univ., Dept. of Theoretical and Applied Mechanics, Urbana, IL USA

**A Microforce-Based Theory for Energetic Materials**

Ruderman, Gregory A.; Stewart, D. S.; Fried, Eliot; Jun. 08, 1999; 3p; In English

Contract(s)/Grant(s): F04611-98-C-0005; AF Proj. 1011

Report No.(s): AD-A409445; AFRL-PR-ED-AB-1999-052; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Employing advanced tools of continuum thermomechanics, we have developed a fully three-dimensional framework, which in its most general form is able to model all the mentioned behaviors of energetic materials. The concept of microforces, forces that drive changes in material microstructure, is employed to generate consistent equations of evolution for combustion and phase transitions. The method of generating equations for thermomechanical behavior using microforces begins with the generation of a free-energy function that encompasses all the material changes. The Clausius-Duhem inequality, a statement of the second law of thermodynamics, is then applied, restricting the material behavior to be thermodynamically correct a priori. Appropriate forms of coupling behavior and dissipation functions are derived.

DTIC

*Thermodynamics; High Energy Propellants; Phase Transformations; Solid Rocket Propellants*

**20030015423** Air Force Research Lab., Propulsion Directorate West, Edwards AFB, CA USA

**Progress in Advanced Propellant Research**

Harper, Jessica; May 02, 2000; 3p; In English; Pres. at Advanced Space Propulsion Research Workshop (11th). Held in Pasadena, CA, 31 May-2 Jun 2000

Contract(s)/Grant(s): AF Proj. 1011

Report No.(s): AD-A409441; AFRL-PR-ED-AB-2000-098; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

While alternative propulsion systems advance towards maturity, a reliance on traditional chemical propulsion remains. This continued use of chemical propulsion allows space-related industry and agencies to draw on existing assets, infrastructure, and experience with the established technologies in this area. Chemical propulsion can therefore be a less costly, more readily accessible propulsion option. Because of these advantages, research to push chemical propulsion systems to their theoretical limits is ongoing in parallel with development of other propulsion options. The mission of the Propulsion Directorate of the Air Force Research Laboratory is discovery and development of revolutionary and evolutionary improvements in several areas of chemical propulsion. This talk will cover new results in four propellant research programs. The ongoing AFOSR sponsored cryogenic solid High Energy Density Matter (HEDM) program has made progress towards the goal of trapping energetic species in solid hydrogen to create propellant with performance exceeding that of LOX/LH2. Achievements include production of solid hydrogen in centimeter thick samples and generation of HEDM species for isolation in solid hydrogen. A DARPA funded program, which also receives AFOSR support, made a breakthrough with synthesis of the N5+ cation, the first all nitrogen species to be discovered in over 100 years. This cation could be the first step to a very high performance monopropellant composed entirely of nitrogen. Significant successes have also been recently made in a monopropellant development program targeted to replace hydrazine with much lower toxicity and higher performance propellants. Monopropellant formulations from this effort have predicted performance exceeding that of some bipropellant systems. Testing and characterization is underway.

DTIC

*High Energy Propellants; Monopropellants; Rocket Propellants; Research and Development*

**20030015424** Engineering Research and Consulting, Inc., Edwards AFB, CA USA

**Adiabatic Compression Sensitivity of Liquid Fuels and Monopropellants**

Ismail, Ismail M. K.; Hawkins, Tom W.; Dec. 29, 1999; 13p; In English; Presented at Intl. Instrumentation Symposium (46th). Held in Bellevue, WA, 30 Apr-4 May 2000

Contract(s)/Grant(s): AF Proj. 1011

Report No.(s): AD-A409440; AFRL-PR-ED-TP-1999-0255; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

Liquid rocket fuels and monopropellants can be sensitive to rapid compression. Such liquids may undergo decomposition and their handling may be accompanied with risk. Decomposition produces small gas bubbles in the liquid, which upon rapid compression may cause catastrophic explosions. The rapid compression can result from mechanical shocks applied on the tank containing the liquid or from rapid closure of the valves installed on the lines. It is desirable to determine the conditions that may promote explosive reactions. At AFRL, we constructed an apparatus and established a safe procedure for estimating the sensitivity of propellant materials towards mechanical shocks (Adiabatic Compression Tester). A sample is placed in a stainless steel U-tube, held isothermally at a temperature between 20 and 150 degrees Celsius then exposed to an abrupt mechanical shock of nitrogen gas at a pressure between 6.9 and 20.7 MPa (1000 to 3000 psi). The apparatus is computer interfaced and is driven with LABTECH NOTEBOOK-pro Software. In this presentation, the design of the apparatus is shown, the operating procedure is outlined and the safety issues are addressed. The results obtained on different energetic materials will be presented.

DTIC

*Adiabatic Conditions; Compression Tests; Liquid Fuels; Monopropellants; Propellant Sensitivity*

**20030015425** Engineering Research and Consulting, Inc., Edwards AFB, CA USA

**Adiabatic Compression Sensitivity of Liquid Fuels and Monopropellants**

Ismail, Ismail M. K.; Hawkins, Tom W.; Apr. 24, 2000; 22p; In English; Instrumentation Symposium (46th). Held in Bellevue, WA, 30 Apr-4 May 2000. Viewgraphs only

Contract(s)/Grant(s): AF Proj. 1011

Report No.(s): AD-A409439; AFRL-PR-ED-TP-2000-086; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

Slides from presentation given on adiabatic compression sensitivity of liquid fuels and monopropellants.

DTIC

*Adiabatic Conditions; Monopropellants; Compression Loads; Sensitivity Analysis; Liquid Fuels*

**20030015427** Air Force Research Lab., Propulsion Directorate West, Edwards AFB, CA USA

**New Propellants and Propulsion Techniques**

Carrick, Patrick; Apr. 30, 1998; 10p; In English

Contract(s)/Grant(s): AF Proj. 1011

Report No.(s): AD-A409435; AFRL-PR-ED-TP-1998-089; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Presentation of current Air Force research on propellants and propulsion.

DTIC

*High Energy Propellants; Propulsion System Performance; Artificial Satellites*

**20030015432** Air Force Research Lab., Space and Missile Propulsion Div., Edwards AFB, CA USA

**Laboratory Characterization of High Energy Materials**

Brand, A. J.; Hawkins, T. W.; Mckay, M. B.; Ismail, I. M.; Jun. 10, 1999; 14p; In English

Contract(s)/Grant(s): AF Proj. 1011

Report No.(s): AD-A409421; AFRL-PR-ED-TP-FY99-0102; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

AFN has demonstrated acceptable properties to further propellant development: displayed good stability (thermal, friction, impact and detonability), low melt point is suitable for monopropellant applications, and extremely low toxic vapor concentrations. AFN based propellant has been evaluated to indicate additional development is warranted: high performance demonstrated in thruster test bed, acceptable safety properties and low toxic vapor concentrations.

DTIC

*Rocket Propellants; Evaluation*

**20030015737** Energy Information Administration, Washington, DC USA

**Short-Term Energy Outlook, November 2002**

Nov. 2002; In English

Report No.(s): PB2003-102477; No Copyright; Avail: National Technical Information Service (NTIS)

During the past 3-4 months, OPEC 10 production has risen more quickly than projected, thus reducing upward pressure on prices. More specifically, while the West Texas Intermediate (WTI) crude oil spot price averaged \$28.84 in October, about \$6.70 per barrel above the year-ago level, the WTI average price for fourth quarter 2002 is now projected to soften to \$28.20, which is about \$2 per barrel below our fourth-quarter projection from last month. Meanwhile, OECD inventory levels, which are now approaching 5-year lows, should begin to rise over the next few months as additional supplies reach markets, and return to the middle of their observed range by spring.

NTIS

*Crude Oil; Supplying*

**20030015738** Energy Information Administration, Washington, DC USA

**Short-Term Energy Outlook, October 2002**

Oct. 2002; In English

Report No.(s): PB2003-102478; No Copyright; Avail: National Technical Information Service (NTIS)

Continued high oil prices are the result of declining OECD commercial oil inventories, worries over a potential clash with Iraq, and OPEC's decision to leave production quotas unchanged at its September meeting. Solid growth in world oil demand this winter (and for 2003 as a whole) is likely to tighten world oil markets and reduce commercial oil inventories. The West Texas Intermediate (WTI) crude oil spot price averaged \$29.75 in September, about \$3.50 per barrel above the year-ago level and about \$10 per barrel above a low point seen last January.

NTIS

*Forecasting; Supplying; Crude Oil*

**20030015779** Air Force Research Lab., Space and Missile Propulsion Div., Edwards AFB, CA USA

**Subcritical Crack Growth in a Composite Solid Propellant**

Baron, D. T.; Liu, C. T.; Miller, T. C.; Jun. 10, 1998; 15p; In English

Contract(s)/Grant(s): AF Proj. 1011

Report No.(s): AD-A409365; AFRL-PR-ED-TP-1998-111; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

UNIaxial tension tests using a strain rate of 0.04 in./in./min. are performed on rectangular smooth and single edge-notched specimens of varying thicknesses for a composite solid propellant. Stress strain, crack growth, crack growth rate and crack growth resistance data are provided. Thickness effects and the mechanism of crack growth are described. Methods of calculation are explained for the crack growth rate and the Mode 1 stress intensity factor. A model is developed for the crack stable growth rate as a function of the stress intensity factor. UNIaxial tension tests using a strain rate of 0.04 in./in./min. are performed on rectangular smooth and single edge-notched specimens of varying thicknesses for a composite solid propellant. Stress-strain, crack growth, crack growth rate and crack growth resistance data are provided. Thickness effects and the mechanism of crack growth are described. Methods of calculation are explained for the crack growth rate and the Mode 1 stress intensity factor. A model is developed for the crack stable growth rate as a function of the stress intensity factor.

DTIC

*Crack Propagation; Solid Propellants; Composite Propellants*

## 29

### SPACE PROCESSING

*Includes space-based development of materials, compounds, and processes for research or commercial application. Also includes the development of materials and compounds in simulated reduced-gravity environments. For legal aspects of space commercialization see 84 Law, Political Science and Space Policy.*

**20030014727** Ohio State Univ., Lab. for Space Geodesy and Remote Sensing Research, Columbus, OH USA

**High-Resolution Gravity and Time-Varying Gravity Field Recovery using GRACE and CHAMP Final Report, 1 Aug. 1998 - 31 Jul. 2002**

Shum, C. K., Ohio State Univ., USA; Dec. 20, 2002; 16p; In English; Original contains color illustrations

Contract(s)/Grant(s): NAG5-7574; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This progress report summarizes the research work conducted under NASA's Solid Earth and Natural Hazards Program 1998 (SENH98) entitled High Resolution Gravity and Time Varying Gravity Field Recovery Using GRACE (Gravity Recovery and Climate Experiment) and CHAMP (Challenging Mini-satellite Package for Geophysical Research and Applications), which included a no-cost extension time period. The investigation has conducted pilot studies to use the simulated GRACE and CHAMP

data and other in situ and space geodetic observable, satellite altimeter data, and ocean mass variation data to study the dynamic processes of the Earth which affect climate change. Results from this investigation include: (1) a new method to use the energy approach for expressing gravity mission data as in situ measurements with the possibility to enhance the spatial resolution of the gravity signal; (2) the method was tested using CHAMP and validated with the development of a mean gravity field model using CHAMP data, (3) elaborate simulation to quantify errors of tides and atmosphere and to recover hydrological and oceanic signals using GRACE, results show that there are significant aliasing effect and errors being amplified in the GRACE resonant geopotential and it is not trivial to remove these errors, and (4) quantification of oceanic and ice sheet mass changes in a geophysical constraint study to assess their contributions to global sea level change, while the results improved significant over the use of previous studies using only the SLR (Satellite Laser Ranging)-determined zonal gravity change data, the constraint could be further improved with additional information on mantle rheology, PGR (Post-Glacial Rebound) and ice loading history. A list of relevant presentations and publications is attached, along with a summary of the SENH investigation generated in 2000. Derived from text

*Geophysics; Gravitational Fields; Satellite Observation; Geodesy; Climate Change*

**20030014891** Johns Hopkins Univ., Chemical Propulsion Information Agency, Columbia, MD USA

**20th JANNAF Propulsion Systems Hazards Subcommittee Meeting, Volume 1, Nov. - Apr. 2002**

Cocchiaro, James E., Editor, Johns Hopkins Univ., USA; Eggleston, Debra S., Editor, Johns Hopkins Univ., USA; Gannaway, Mary T., Editor, Johns Hopkins Univ., USA; Inzar, Jeanette M., Editor, Johns Hopkins Univ., USA; 20th JANNAF Propulsion Systems Hazards Subcommittee Meeting; April 2002; 336p; In English; 20th Propulsion Systems Hazards Subcommittee, 8-12 Apr. 2002, Destin, FL, Destin, FL, Destin, FL, Destin, FL, USA, USA, USA, USA; Sponsored by Department of the Army, USA; Also announced as 20030014892 through 20030014915

Contract(s)/Grant(s): SPO700-97-D-4004

Report No.(s): CPIA-Publ-714-Vol-1; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC

This volume, the first of two volumes, is a collection of 24 unclassified/unlimited-distribution papers which were presented at the Joint Army-Navy-NASA-Air Force (JANNAF) 20th Propulsion Systems Hazards Subcommittee (PSHS), 38th Combustion Subcommittee (CS), 26th Airbreathing Propulsion Subcommittee (APS), and 21 Modeling and Simulation Subcommittee meeting. The meeting was held 8-12 April 2002 at the Bayside Inn at The Sandestin Golf & Beach Resort and Eglin Air Force Base, Destin, Florida. Topics covered include: insensitive munitions and hazard classification testing of solid rocket motors and other munitions; vulnerability of gun propellants to impact stimuli; thermal decomposition and cookoff properties of energetic materials; burn-to-violent reaction phenomena in energetic materials; and shock-to-detonation properties of solid propellants and energetic materials.

Author

*Conferences; Combustion; Propulsion System Configurations; Propulsion System Performance; Solid Propellant Rocket Engines*

## 31

### ENGINEERING (GENERAL)

*Includes general research topics to engineering and applied physics, and particular areas of vacuum technology, industrial engineering, cryogenics, and fire prevention. For specific topics in engineering see categories 32 through 39.*

**20030014821** NASA Marshall Space Flight Center, Huntsville, AL USA

**Lessons Learned and Technical Standards: A Logical Marriage for Future Space Systems Design**

Gill, Paul S., NASA Marshall Space Flight Center, USA; Garcia, Danny, NASA Marshall Space Flight Center, USA; Vaughan, William W., Alabama Univ., USA; [2002]; 7p; In English; 53rd International Astronautical Congress Session U.3. Systems Engineering, Tools and Processes, 17 Oct. 2002, Houston, TX, USA; Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche; Distribution as joint owner in the copyright; Distribution as joint owner in the copyright

A comprehensive database of engineering lessons learned that corresponds with relevant technical standards will be a valuable asset to those engaged in studies on future space vehicle developments, especially for structures, materials, propulsion, control, operations and associated elements. In addition, this will enable the capturing of technology developments applicable to the design, development, and operation of future space vehicles as planned in the Space Launch Initiative. Using the time-honored tradition of passing on lessons learned while utilizing the newest information technology, NASA has launched an intensive effort to link lessons learned acquired through various Internet databases with applicable technical standards. This paper will discuss

the importance of lessons learned, the difficulty in finding relevant lessons learned while engaged in a space vehicle development, and the new NASA effort to relate them to technical standards that can help alleviate this difficulty.

Author

*Systems Engineering; Aerospace Systems; Standards; Data Bases*

**20030016190** National Inst. of Standards and Technology, Manufacturing Engineering Lab., Gaithersburg, MD USA

**Measuring the Performance and Intelligence of Systems: Proceedings of the 2002 PerMIS Workshop**

Messina, E. R.; Meystel, A. M.; Sep. 2002; 488p; In English, 1315 Aug. 2002, Gaithersburg, MD, USA; See also PB2002-109203 Report No.(s): PB2003-102175; NUST/SP-990; No Copyright; Avail: CASI; A21, Hardcopy; A04, Microfiche

Contents include the following: Performance Metrics; Performance of Multiple Agents; Performance of Mobility Systems; Performance of Planning Systems; General Discussion Panel 1; Uncertainty of Representation I; Performance of Robots in Hazardous Domains; Modeling Intelligence; Modeling of Mind; Measuring Intelligence; Grouping: A Core Procedure of Intelligence; Uncertainty in Representation II; Towards Universal Planning/Control Systems.

NTIS

*Conferences; Artificial Intelligence*

**20030017832** NASA Marshall Space Flight Center, Huntsville, AL USA

**Statistical Evaluation and Improvement of Methods for Combining Random and Harmonic Loads**

Brown, A. M., NASA Marshall Space Flight Center, USA; McGhee, D. S., NASA Marshall Space Flight Center, USA; February 2003; 36p; In English

Report No.(s): NASA/TP-2003-212257; M-1062; NAS 1.60:212257; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Structures in many environments experience both random and harmonic excitation. A variety of closed-form techniques has been used in the aerospace industry to combine the loads resulting from the two sources. The resulting combined loads are then used to design for both yield/ultimate strength and high-cycle fatigue capability. This Technical Publication examines the cumulative distribution percentiles obtained using each method by integrating the joint probability density function of the sine and random components. A new Microsoft Excel spreadsheet macro that links with the software program Mathematica to calculate the combined value corresponding to any desired percentile is then presented along with a curve fit to this value. Another Excel macro that calculates the combination using Monte Carlo simulation is shown. Unlike the traditional techniques, these methods quantify the calculated load value with a consistent percentile. Using either of the presented methods can be extremely valuable in probabilistic design, which requires a statistical characterization of the loading. Additionally, since the CDF at high probability levels is very flat, the design value is extremely sensitive to the predetermined percentile; therefore, applying the new techniques can substantially lower the design loading without losing any of the identified structural reliability.

Author

*Structural Reliability; Loads (Forces); Random Vibration; Dynamic Structural Analysis; Rocket Engines; Probability Theory; Statistical Analysis*

**20030017982** Phillips Lab., Advanced Isogrid Design Innovative Technology, Albuquerque, NM USA

**Design and Analysis of Composite Isogrid for Bridge Construction**

Koury, James L., Phillips Lab., USA; Dutta, Piyush K., Army Cold Regions Research and Engineering Lab., USA; Technology 2003: The Fourth National Technology Transfer Conference and Exposition; Feb. 01, 1994; Volume 1, pp. 377-384; In English; Technology 2003: The Fourth National Technology Transfer Conference and Exposition, 7-9 Dec. 1993, Anaheim, CA, USA; Sponsored by NASA, USA; Also announced as 19940025935; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

This paper describes the use of continuous composite isogrid structures for potential applications in bridge decks. Preliminary design and analysis are presented showing the capability and reliability of this structure. Fabrication, and mechanical and thermal properties for the structure are presented. Low cost materials and fabrication techniques available are also discussed.

Author

*Fabrication; Mechanical Properties; Thermodynamic Properties; Composite Structures; Bridges (Structures); Structural Design*

**20030018252** National Academy of Sciences - National Research Council, Elgin AFB, USA

**Bolonkin's Method Movement of Vehicles and Installation For It**

Bolonkin, Alexander, Inventor, National Academy of Sciences - National Research Council, USA; Dec. 17, 2002; 1p; In English Patent Info.: Filed 28 Jun. 2001; US-Patent-6,494,143; US-Patent-Appl-SN-893060; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The method and facilities for movement of vehicles over long distances are presented. The Method is comprised of the following steps: (a) connecting at least two main rollers displaced over a long distance: one in a port of departure and one in a port of arrival, by a series of closed-loop, light strong cable (consisting of one or more loops) located at least in one of the following places: in the air, on the ground surface, on the water surface; (b) supporting said cable by at least one of the following devices: wings, air balloons, columns, rollers; (c) connecting at least one of said main rollers to an engine; (d) running said engine; (e) connecting at least one load vehicle to said cable at (f) accelerating said vehicle; (g) disconnecting said vehicles from said cable at arrival (h) braking said vehicles. An installation using Method for Movement of vehicles comprising: A set of rollers disposed in the ports of departure, arrival, at points of direction change, and at middle points; a set of light, strong, closed-loop cables (loops) connect the ports of departure and arrival located over a long distance; engines placed near rollers and connected at least to one of said rollers; vehicles for transportation of people and loads; devices for connection and disconnection of the vehicles to the cable and placed on the vehicles. The author also proposes 5 projects: an air bridge over the Straits of Gibraltar, airlines connecting New York to Washington D.C., and New York to Paris, airline for delivery of fuel gas, and typical Auto Highways or city passenger transit systems.

Official Gazette of the U.S. Patent and Trademark Office

*Transportation; Motion; Transport Vehicles*

**20030018445** Defence Science and Technology Organisation, Edinburgh, Australia

**Design Oriented Verification and Evaluation: The Dove Project**

Cant, Tony, Defence Science and Technology Organisation, Australia; Mahony, Brendan, Defence Science and Technology Organisation, Australia; McCarthy, Jim, Defence Science and Technology Organisation, Australia; December 2002; 162p; In English

Report No.(s): DSTO-TR-1349; DODA-AR-012-457; Copyright; Avail: Issuing Activity

DOVE is a graphical tool for modelling and reasoning about state machine designs for critical systems. This report summarizes its technical development, and incorporates the user manual.

Author

*Program Verification (Computers); Proving; Research and Development; Models*

## 32

### COMMUNICATIONS AND RADAR

*Includes radar; radio, wire, and optical communications; land and global communications; communications theory. For related information see also 04 Aircraft Communications and Navigation; and 17 Space Communications, Spacecraft Communications, Command and Tracking; for search and rescue see 03 Air Transportation and Safety, and 16 Space Transportation and Safety.*

**20030014744** NASA Marshall Space Flight Center, Huntsville, AL USA

**Structural Modeling of a Five-Meter Thin Film Inflatable Antenna/Concentrator**

Smalley, Kurt B., NASA Marshall Space Flight Center, USA; Tinker, Michael L., NASA Marshall Space Flight Center, USA; Taylor, W. Scott, NASA Marshall Space Flight Center, USA; [2002]; 16p; In English; Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche; Distribution as joint owner in the copyright; Distribution as joint owner in the copyright

Inflatable structures have been the subject of renewed interest in recent years for space applications such as communications antennas, solar thermal propulsion, and space solar power. A major advantage of using inflatable structures in space is their extremely light weight. An obvious second advantage is on-orbit deployability and related space savings in the launch configuration. A recent technology demonstrator flight for inflatable structures was the Inflatable Antenna Experiment (IAE) that was deployed on orbit from the Shuttle Orbiter. Although difficulty was encountered in the inflation/deployment phase, the flight was successful overall and provided valuable experience in the use of such structures. Several papers on static structural analysis of inflated cylinders have been written, describing different techniques such as linear shell theory, and nonlinear and variational methods, but very little work had been done in dynamics of inflatable structures until recent years. In 1988 Leonard indicated that elastic beam bending modes could be utilized in approximating lower-order frequencies of inflatable beams. Main, et al. wrote a very significant 1995 paper describing results of modal tests of inflated cantilever beams and the determination of effective material properties. Changes in material properties for different pressures were also discussed, and the beam model was used in a more complex structure. The paper demonstrated that conventional finite element analysis packages could be very useful in the analysis of complex inflatable structures. The purposes of this paper are to discuss the methodology for dynamically characterizing a large 5-meter thin film inflatable reflector, and to discuss the test arrangement and results. Nonlinear finite element modal results are compared to modal test data. The work is significant and of considerable interest to researchers because

of 1) the large size of the structure, making it useful for scaling studies, and 2) application of commercially available finite element software for modeling pressurized thin-film structures.

Author

*Inflatable Space Structures; Thin Films; Antennas; Reflectors; Dynamic Structural Analysis*

**20030014749** NASA Langley Research Center, Hampton, VA USA

**Determination of Receiver Susceptibility to Radio Frequency Interference from Portable Electronic Devices**

Nguyen, Truong X., NASA Langley Research Center, USA; Ely, Jay J., NASA Langley Research Center, USA; [2002]; 13p; In English; 21st Digital Avionics Systems Conference, 27-31 Oct. 2002, Irvine, CA, USA; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

With the increasing pressures to allow wireless devices on aircraft, the susceptibility of aircraft receivers to interference from Portable Electronic Devices (PEDs) becomes an increasing concern. Many investigations were conducted in the past, with limited success, to quantify device emissions, path loss, and receiver interference susceptibility thresholds. This paper outlines the recent effort in determining the receiver susceptibility thresholds for ILS, VOR and GPS systems. The effort primarily consists of analysis of data available openly as reported in many RTCA and ICAO documents as well as manufacturers data on receiver sensitivity. Shortcomings with the susceptibility threshold data reported in the RTCA documents are presented, and an approach for an in-depth study is suggested. In addition, intermodulation products were observed and demonstrated in a laboratory experiment when multiple PEDs were in the proximity of each other. These intermodulation effects generate spurious frequencies that may fall within aircraft communication or navigation bands causing undesirable effects. Results from a preliminary analysis are presented that show possible harmful combinations of PEDs and the potentially affected aircraft bands.

Author

*Aircraft Equipment; Receivers; Electronic Equipment; Radio Frequency Interference*

**20030014805** NASA Langley Research Center, Hampton, VA USA

**Electromagnetic Interference Assessment of CDMA and GSM Wireless Phones to Aircraft Navigation Radios**

Ely, Jay J., NASA Langley Research Center, USA; Nguyen, Truong X., NASA Langley Research Center, USA; Koppen, Sandra V., Lockheed Martin Corp., USA; Salud, M. Theresa, Lockheed Martin Corp., USA; [2002]; 12p; In English; 21st Digital Avionics Systems Conference, 27-31 Oct. 2002, Irvine, CA, USA; Original contains color illustrations; Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche; Distribution as joint owner in the copyright; Distribution as joint owner in the copyright

To address the concern for cellular phone electromagnetic interference (EMI) to aircraft radios, a radiated emission measurement process for CDMA (IS-95) and GSM (ETSI GSM 11.22) wireless handsets was developed. Spurious radiated emissions were efficiently characterized from devices tested in either a semi-anechoic or reverberation chamber, in terms of effective isotropic radiated power. Eight representative handsets (4 GSM, 4 CDMA) were commanded to operate while varying their radio transmitter parameters (power, modulation, etc.). This report provides a detailed description of the measurement process and resulting data, which may subsequently be used by others as a basis of consistent evaluation for cellular/PCS phones, Bluetooth, IEEE802.11b, IEEE802.11a, FRS/GMRS radios, and other portable transmitters. Aircraft interference path loss (IPL) and navigation radio interference threshold data from numerous reference documents, standards, and NASA partnerships were compiled. Using this data, a preliminary risk assessment is provided for CDMA and GSM wireless phone interference to aircraft localizer, Glideslope, VOR, and GPS radio receivers on typical transport airplanes. The report identifies where existing data for device emissions, IPL, and navigation radio interference thresholds needs to be extended for an accurate risk assessment for wireless transmitters in aircraft.

Author

*Code Division Multiple Access; Electromagnetic Interference; Air Navigation; Wireless Communication; Radio Communication; Telephones; Radio Transmitters*

**20030014939** Old Dominion Univ., Dept. of Electrical and Computer Engineering, Norfolk, VA USA

**Development of Numerical Codes for Modeling Electromagnetic Behavior at High Frequencies Near Large Objects *Final Report***

Joshi, R. P., Old Dominion Univ., USA; January 2003; 53p; In English; Original contains color illustrations

Contract(s)/Grant(s): NAG1-01071; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

A study into the problem of determining electromagnetic solutions at high frequencies for problems involving complex geometries, large sizes and multiple sources (e.g. antennas) has been initiated. Typical applications include the behavior of antennas (and radiators) installed on complex conducting structures (e.g. ships, aircrafts, etc..) with strong interactions between antennas, the radiation patterns, and electromagnetic signals is of great interest for electromagnetic compatibility control. This

includes the overall performance evaluation and control of all on-board radiating systems, electromagnetic interference, and personnel radiation hazards. Electromagnetic computational capability exists at NASA LaRC, and many of the codes developed are based on the Moment Method (MM). However, the MM is computationally intensive, and this places a limit on the size of objects and structures that can be modeled. Here, two approaches are proposed: (i) a current-based hybrid scheme that combines the MM with Physical optics, and (ii) an Alternating Direction Implicit-Finite Difference Time Domain (ADI-FDTD) method. The essence of a hybrid technique is to split the overall scattering surface(s) into two regions: (a) a MM zone (MMZ) which can be used over any part of the given geometry, but is most essential over irregular and "non-smooth" geometries, and (b) a PO sub-region (POSR). Currents induced on the scattering and reflecting surfaces can then be computed in two ways depending on whether the region belonged to the MMZ or was part of the POSR. For the MMZ, the current calculations proceed in terms of basis functions with undetermined coefficients (as in the usual MM method), and the answer obtained by solving a system of linear equations. Over the POSR, conduction is obtained as a superposition of two contributions: (i) currents due to the incident magnetic field, and (ii) currents produced by the mutual induction from conduction within the MMZ. This effectively leads to a reduction in the size of linear equations from  $N$  to  $N - N_{po}$  with  $N$  being the total number of segments for the entire surface and  $N_{po}$  the number of segments over the POSR. The scheme would be appropriate for relatively large, flat surfaces, and at high frequencies. The ADI-FDTD scheme provides for both transient and steady state analyses. The restrictive Courant-Friedrich-Levy (CFL) condition on the time-step is removed, and so large time steps can be chosen even though the spatial grids are small. This report includes the problem definition, a detailed discussion of both the numerical techniques, and numerical implementations for simple surface geometries. Numerical solutions have been derived for a few simple situations.

Author

*Electromagnetic Compatibility; Electromagnetic Interference; High Frequencies; Mathematical Models; Surface Geometry; Computer Programs*

**20030015487** NASA Ames Research Center, Moffett Field, CA USA

**Evolutionary Optimization of Quadrifilar Helical and Yagi-Uda Antennas**

Lohn, Jason D., NASA Ames Research Center, USA; Kraus, William F., QSS Group, Inc., USA; Linden, Derek S., Linden Innovation Research, USA; Stoica, Adrian, Jet Propulsion Lab., California Inst. of Tech., USA; [2002]; 7p; In English; Third WSES International Conference on Evolutionary Computation, Unknown; Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche; Distribution as joint owner in the copyright; Distribution as joint owner in the copyright

We present optimization results obtained for two type of antennas using evolutionary algorithms. A quadrifilar helical UHF antenna is currently flying aboard NASA's Mars Odyssey spacecraft and is due to reach final Martian orbit insertion in January, 2002. Using this antenna as a benchmark, we ran experiments employing a coevolutionary genetic algorithm to evolve a quadrifilar helical design in-situ - i.e., in the presence of a surrounding structure. Results show a 93% improvement at 400 MHz and a 48% improvement at 438 MHz in the average gain. The evolved antenna is also one-fourth the size. Yagi-Uda antennas are known to be difficult to design and optimize due to their sensitivity at high gain and the inclusion of numerous parasitic elements. Our fitness calculation allows the implicit relationship between power gain and sidelobe/backlobe loss to emerge naturally, a technique that is less complex than previous approaches. Our results include Yagi-Uda antennas that have excellent bandwidth and gain properties with very good impedance characteristics. Results exceeded previous Yagi-Uda antennas produced via evolutionary algorithms by at least 7.8% in mainlobe gain.

Author

*Optimization; Hardware; Ultrahigh Frequencies; Parasitic Elements (Antennas); Helical Antennas*

**20030016092** Defence Science and Technology Organisation, Command and Control Div., Edinburgh, Australia

**Interfacing COTS Speech Recognition and Synthesis Software to a Lotus Notes Military Command and Control Database**

Carr, Oliver, Defence Science and Technology Organisation, Australia; October 2002; 28p; In English

Contract(s)/Grant(s): DSTO Proj. JNT-01/092

Report No.(s): DSTO-TR-1358; DODA-AR-012-066; Copyright; Avail: Issuing Activity

Speech recognition and synthesis technologies have become commercially viable over recent years. Two current market leading products in speech recognition technology are Dragon NaturallySpeaking and IBM ViaVoice. This report describes the development of speech user interfaces incorporating these products with Lotus Notes and Java applications. These interfaces enable data entry using speech recognition and allow warnings and instructions to be issued via speech synthesis. The development of a military vocabulary to improve user interaction is discussed. The report also describes an evaluation in terms of speed of the

various speech user interfaces developed using Dragon NaturallySpeaking and IBM ViaVoice with a Lotus Notes Command and Control Support System Log database.

Author

*Applications Programs (Computers); Speech Recognition; Commercial Off-The-Shelf Products; Military Technology*

**20030016192** Defence Science and Technology Organisation, Air Operations Div., Adelaide, Australia

**A Virtual Information-Action Workspace for Command and Control**

Lintern, Gavan, Defence Science and Technology Organisation, Australia; Naikar, Neelam, Defence Science and Technology Organisation, Australia; October 2002; 12p; In English

Report No.(s): DSTO-TR-1299; DODA-AR-012-298; Copyright; Avail: Issuing Activity

Information overload has become a critical challenge within military Command and Control. However, the problem is not so much one of too much information but of abundant information that is poorly organized and poorly represented. In addition, the capabilities to test the effects of decisions before they are implemented and to monitor the progress of events after a decision is implemented are primitive. A virtual information-action workspace could be designed to resolve these issues. The design of such a space would require a detailed understanding of the specific information needed to support decision making in Command and Control. That information can be obtained with the use of knowledge acquisition and knowledge representation tools from the field of applied cognitive psychology. In addition, it will be necessary to integrate forms for perception and action into a virtual space that will support access to the information and that will provide means for testing and implementing decisions. This paper presents a rationale for a virtual information-action workspace and outlines an approach to its design.

Author

*Information Management; Workstations; Decision Making; Virtual Reality*

**20030016580** Argonne National Lab., IL USA

**More than Just Wires: Applying Complexity Theory to Communication Network Assurance**

North, M. J.; Thomas, W. H.; Macal, C. M.; Miller, D. J.; Peerenboom, J. P.; 2002; 10p; In English

Report No.(s): DE2002-801588; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Complexity Theory is the study of order within otherwise chaotic systems (Holland, 1999). Complexity Theory often focuses on Complex Adaptive Systems (CAS). A CAS is a system of components that interact and reproduce while adapting to their environment. A CAS consists of large numbers of components that are diverse in both form and capability. A CAS exhibits unstable coherence in spite of constant disruptions and a lack of central planning. Large-scale, interconnected infrastructures such as communication networks are CAS. These infrastructures are vastly more dynamic than their predecessors. Such infrastructures consist of a large number of components and participants that are diverse in both form and capability. Furthermore, these infrastructures exhibit unstable coherence in spite of constant disruptions and a lack of central planning. Viewing large-scale, interconnected infrastructures with complex physical architectures, such as communication networks, as CAS can provide many new insights (Bower and Bunn, 2000; North, 2000a, 2000b, and 2001). The CAS approach emphasizes the specific evolution of integrated infrastructures and their participants' behavior, not just simple trends or end states. The adaptation of the infrastructure participants to changing conditions is paramount. Also, the effects of random events and uncertainty are explicitly considered. One powerful computational approach to understanding CAS is agent-based modeling and simulation (ABMS).

NTIS

*Communication Networks; Complex Systems; Viewing*

**20030016722** Texas A&M Univ., Texas Transportation Inst., College Station, TX USA

**Use of Ground Penetrating Radar for Site Investigation of Low-Volume Roadways and Design Recommendations, Sep. 1998 - Aug. 2001**

Scullion, T.; Saarenketo, T.; Jul. 2002; 62p; In English

Report No.(s): PB2003-101569; TTI-7-4906; RR-4906-1; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This report will present several case studies describing the use of ground penetrating radar (GPR) technology for site investigations. Two types of GPR will be described-the air-launched and ground-coupled systems. The use of air-launched radar is well established within the Texas Department of Transportation (TXDOT). The limitation of this technology is its depth of penetration. While providing very useful information on the surface and base layers, it provides little information on the sub-grade soils. The use of low-frequency ground-coupled radar systems will provide little useful near-surface information but it can provide data on sub-grade properties and how they vary along a project. Combining both radar types can potentially provide a comprehensive subsurface investigative tool for both new pavement construction and for major pavement rehabilitation projects. In this report a brief description will be provided of the different systems together with the software used to process the GPR

signals. Air-launched data are processed with the COLORMAP system developed by the Texas Transportation Institute. The ground-coupled data are processed using the Road Doctor system developed by Roadscanners, Inc. of Finland. The case studies presented were collected on actual TXDOT evaluation projects mainly in the Bryan District. They range from near-surface applications where the goal was to identify changes in pavement structure which were not available in construction records to identifying the areas beneath the pavement subsidence associated with strip mining activities.

NTIS

*Design Analysis; Ground Tests; Pavements; Roads; Data Acquisition*

**20030018107** Osaka City Univ., Dept. of Physical Electronics and Informatics, Japan

**On the PC Interface for Hearing-Impaired**

Kitamura, Mitsuhiro, Osaka City Univ., Japan; Akiyama, Kouichi, Osaka City Univ., Japan; Hama, Hiromitsu, Osaka City Univ., Japan; *Memoirs of the Faculty of Engineering, Osaka City University*; December 2002; ISSN 0078-6659; Volume 43, pp. 31-36; In English; Copyright; Avail: Issuing Activity

A human being takes in the outer world information by using the five senses, and lives. So he is forced very inconvenient life even when one sense is missing. Among others, it is said that the sense of hearing has importance next to the sight, but it is one of the organs which surely become weak with aging, and "hearing defect" is particularly the problem which all people face someday. But, technically and socially, the system which the person whose physical function is poor can entry into and contribute to the society is very important. In this research, the way of making up for a lost function by the medium change to the sense of touch information from the auditory information is examined, as a help that hearing-impaired gets "safety", "independence", "the tranquility of the heart" from the technical side. In this paper, as a concrete system, it paid attention to the mouse of the PC interface, and a vibration mouse was used under the environment which a PC was being used for, and thought about building of the system which can acquire the sound information of the life environment in real time.

Author

*Sensory Perception; Hearing; Visual Perception; Vibration*

**33**

**ELECTRONICS AND ELECTRICAL ENGINEERING**

*Includes development, performance, and maintainability of electrical/electronic devices and components; related test equipment and microelectronics and integrated circuitry. For related information see also 60 Computer Operations and Hardware; and 76 Solid-State Physics. For communications equipment and devices see 32 Communications and Radar.*

**20030014941** NASA Glenn Research Center, Cleveland, OH USA

**Cryogenic Evaluation of an Advanced DC/DC Converter Module for Deep Space Applications**

Elbuluk, Malik E., Akron Univ., USA; Hammoud, Ahmad, QSS Group, Inc., USA; Gerber, Scott S., ZIN Technologies, Inc., USA; Patterson, Richard, NASA Glenn Research Center, USA; January 2003; 12p; In English; 37th Industry Application Society Annual Meeting, 13-17 Oct. 2002, Pittsburgh, PA, USA; Sponsored by Institute of Electrical and Electronics Engineers, USA Contract(s)/Grant(s): NAS3-00145; RTOP 297-60-05

Report No.(s): NASA/TM-2003-212085; NAS 1.15:212085; E-13738; Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche; Distribution as joint owner in the copyright; Distribution as joint owner in the copyright

DC/DC converters are widely used in power management, conditioning, and control of space power systems. Deep space applications require electronics that withstand cryogenic temperature and meet a stringent radiation tolerance. In this work, the performance of an advanced, radiation-hardened (rad-hard) commercial DC/DC converter module was investigated at cryogenic temperatures. The converter was investigated in terms of its steady state and dynamic operations. The output voltage regulation, efficiency, terminal current ripple characteristics, and output voltage response to load changes were determined in the temperature range of 20 to -140 C. These parameters were obtained at various load levels and at different input voltages. The experimental procedures along with the results obtained on the investigated converter are presented and discussed.

Author

*Voltage Converters (DC to DC); Cryogenic Temperature; Technology Utilization; Spacecraft Power Supplies; Electric Potential; Deep Space*

**20030015403** NASA Langley Research Center, Hampton, VA USA

**Radial Field Piezoelectric Diaphragms**

Bryant, R. G., NASA Langley Research Center, USA; Effinger, R. T., IV, Texas A&M Univ., USA; Copeland, B. M., Jr., NASA

Langley Research Center, USA; [2002]; 6p; In English; Actuator 2002: 8th International Conference on New Actuators, 10-12 Jun. 2002, Bremen, Germany; Original contains color illustrations

Report No.(s): Paper A1.3; Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche; Distribution as joint owner in the copyright; Distribution as joint owner in the copyright

A series of active piezoelectric diaphragms were fabricated and patterned with several geometrically defined Inter-Circulating Electrodes "ICE" and Interdigitated Ring Electrodes "ICE". When a voltage potential is applied to the electrodes, the result is a radially distributed electric field that mechanically strains the piezoceramic along the Z-axis (perpendicular to the applied electric field). Unlike other piezoelectric bender actuators, these Radial Field Diaphragms (RFDs) strain concentrically yet afford high displacements (several times that of the equivalent Unimorph) while maintaining a constant circumference. One of the more intriguing aspects is that the radial strain field reverses itself along the radius of the RFD while the tangential strain remains relatively constant. The result is a Z-deflection that has a conical profile. This paper covers the fabrication and characterization of the 5 cm. (2 in.) diaphragms as a function of poling field strength, ceramic thickness, electrode type and line spacing, as well as the surface topography, the resulting strain field and displacement as a function of applied voltage at low frequencies. The unique features of these RFDs include the ability to be clamped about their perimeter with little or no change in displacement, the environmentally insulated packaging, and a highly repeatable fabrication process that uses commodity materials.

Author

*Radial Distribution; Electrodes; Fabrication; Piezoelectric Ceramics*

**20030015734** Argonne National Lab., Energy Technology Div., IL USA

**NdFeB Magnets Aligned in a 9-T Superconducting Solenoid (asterisk)**

Mulcahy, T. M.; Hull, J. R.; Aug. 2002; 14p; In English

Report No.(s): DE2002-799841; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Commercial-grade magnet powder (Magnequench UG) was uniaxial die-pressed into cylindrical compacts, while being aligned in the 1-T to 8-T DC field of a superconducting solenoid at Argonne National Laboratory. Then, the compacts were added to normal Magnequench UG production batches for sintering and annealing. The variations in magnet properties for different strengths of alignment fields are reported for 15.88-mm (5/8-in.) diameter compacts made with length-to-diameter (L/D) ratios in the range 3.025 and L 1. The best magnets were produced when the powder-filled die was inserted into the active field of the solenoid and then pressed. Improvements in the residual flux density of 8% and in the energy product of 16% were achieved by increasing the alignment field beyond the typical 2-T capabilities of electromagnets. The most improvement was achieved for the compacts with the smallest L/D ratio. The ability to make very strong magnets with small L/D, where self-demagnetization effects during alignment are greatest, would benefit most the production of near-final-shape magnets. Compaction of the magnet powder using a horizontal die and a continuously active superconducting solenoid was not a problem. Although the press was operated in the batch mode for this proof-of-concept study, its design is intended to enable automated production.

NTIS

*Solenoids; Superconductors (Materials); Magnetic Materials; Presses; Powder (Particles)*

**20030015775** BAE Systems, Information and Electronic Warfare Systems, Nashua, NH USA

**Target Resolution in Distributed Sensor Systems**

Blatt, Stephen R.; Oct. 2001; 10p; In English; Original contains color illustrations; See also ADM201471, Papers from the Meeting of the MSS Specialty Group on Battlefield Acoustic and Seismic Sensing, Magnetic and Electric Field Sensors (2001) Held in Applied Physics Lab, Johns Hopkins Univ, Laurel, MD on 24-26 Oct. 2001, volume 2

Contract(s)/Grant(s): N66001-00-C-8054

Report No.(s): AD-A409360; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Remote Situation Awareness capabilities using a field of microsensors are now feasible using recent electronics and communications improvements. For instance, the DARPA SensiT program is based on the concept of cheap, small, and smart devices that host multiple types of onboard sensors, which also possess considerable embedded processing and storage capability, and short-range wireless communications. The devices will be quickly and flexibly deployed for varying missions, potentially in very large numbers, on buildings and bodies, on vehicles, and on ground and under water. Power consumption is critical to surveillance lifetime as well as packaging and deployment techniques. Collaborative processing approaches that build on local collaboration between sensors are attractive because they restrict most communications to near-by sensors, minimizing communication energy requirements and decreasing the possibility of detection and jamming.

DTIC

*Detectors; Targets; Deployment; Surveillance*

**20030016514** Norfolk State Univ., Center for Organic Photonic Materials Research, VA USA

**Synthesis and Characterization of a Novel -D-B-A-B- Block Copolymer System for Light Harvesting Applications**

Sun, Sam-Shajing, Norfolk State Univ., USA; Fan, Zhen, Norfolk State Univ., USA; Wang, Yiqing, Norfolk State Univ., USA; Taft, Charles, Norfolk State Univ., USA; Haliburton, James, Norfolk State Univ., USA; Maaref, Shahin, Norfolk State Univ., USA; [2002]; 10p; In English; CD-ROM contains full text document in PDF format

Contract(s)/Grant(s): F49620-01-0485; NAG3-2289

Report No.(s): NONP-NASA-CD-2002153480; No Copyright; Avail: CASI; C01, CD-ROM; A02, Hardcopy; A01, Microfiche

Supra-molecular or nano-structured electro-active polymers are potentially useful for developing variety inexpensive and flexible shaped opto-electronic devices. In the case of organic photovoltaic materials or devices, for instance, photo induced electrons and holes need to be separated and transported in organic acceptor (A) and donor (D) phases respectively. In this paper, preliminary results of synthesis and characterizations of a coupled block copolymers containing a conjugated donor block RO-PPV and a conjugated acceptor block SF-PPV and some of their electronic/optical properties are presented. While the donor block film has a strong PL emission at around 570 nm, and acceptor block film has a strong PL emission at around 590 nm, the PL emissions of final -B-D-B-A- block copolymer films were quenched over 99%. Experimental results demonstrated an effective photo induced electron transfer and charge separation due to the interfaces of donor and acceptor blocks. The system is very promising for variety light harvesting applications, including "plastic" photovoltaic devices.

Author

*Acceptor Materials; Block Copolymers; Polarization (Charge Separation); Nanostructures (Devices); Light (Visible Radiation); Photoelectricity*

**20030016516** Norfolk State Univ., Dept. of Chemistry, VA USA

**Novel High Efficient Organic Photovoltaic Materials: Final Summary of Research Final Report, 22 Jul. 1999 - 21 Jul. 2002**

Sun, Sam, Norfolk State Univ., USA; [2002]; 6p; In English; CD-ROM contains full text document in PDF format

Contract(s)/Grant(s): NAG3-2289

Report No.(s): NONP-NASA-CD-2002153467; No Copyright; Avail: CASI; C01, CD-ROM; A02, Hardcopy; A01, Microfiche

The objectives and goals of this project were to investigate and develop high efficient, lightweight, and cost effective materials for potential photovoltaic applications, such as solar energy conversion or photo detector devices. Specifically, as described in the original project proposal, the target material to be developed was a block copolymer system containing an electron donating (or p-type) conjugated polymer block coupled to an electron withdrawing (or n-type) conjugated polymer block through a non-conjugated bridge unit. Due to several special requirements of the targeted block copolymer systems, such as electron donating and withdrawing substituents, conjugated block structures, processing requirement, stability requirement, size controllability, phase separation and self ordering requirement, etc., many traditional or commonly used block copolymer synthetic schemes are not suitable for this system. Therefore, the investigation and development of applicable and effective synthetic protocols became the most critical and challenging part of this project. During the entire project period, and despite the lack of a proposed synthetic polymer postdoctoral research associate due to severe shortage of qualified personnel in the field, several important accomplishments were achieved in this project and are briefly listed and elaborated. A more detailed research and experimental data is listed in the Appendix.

Derived from text

*Block Copolymers; Photovoltaic Effect; Polyphenyls; Organic Materials; Nanotechnology*

**20030016549** Norfolk State Univ., Center for Materials Research, VA USA

**Design and Synthesis of Novel Block Copolymers for Efficient Opto-Electronic Applications**

Sun, Sam-Shajing, Norfolk State Univ., USA; Fan, Zhen, Norfolk State Univ., USA; Wang, Yiqing, Norfolk State Univ., USA; Taft, Charles, Norfolk State Univ., USA; Haliburton, James, Norfolk State Univ., USA; Maaref, Shahin, Norfolk State Univ., USA; [2002]; 8p; In English; CD-ROM contains full text document in PDF format

Contract(s)/Grant(s): NAG3-2289

Report No.(s): NONP-NASA-CD-2002153476; No Copyright; Avail: CASI; C01, CD-ROM; A02, Hardcopy; A01, Microfiche

It has been predicted that nano-phase separated block copolymer systems containing electron rich donor blocks and electron deficient acceptor blocks may facilitate the charge carrier separation and migration in organic photovoltaic devices due to improved morphology in comparison to polymer blend system. This paper presents preliminary data describing the design and synthesis of a novel Donor-Bridge-Acceptor (D-B-A) block copolymer system for potential high efficient organic optoelectronic applications. Specifically, the donor block contains an electron donating alkyloxy derivatized polyphenylenevinylene (PPV), the acceptor block contains an electron withdrawing alkyl-sulfone derivatized polyphenylenevinylene (PPV), and the bridge block contains an electronically neutral non-conjugated aliphatic hydrocarbon chain. The key synthetic strategy includes the synthesis

of each individual block first, then couple the blocks together. While the donor block stabilizes and facilitates the transport of the holes, the acceptor block stabilizes and facilitates the transport of the electrons, the bridge block is designed to hinder the probability of electron-hole recombination. Thus, improved charge separation and stability are expected with this system. In addition, charge migration toward electrodes may also be facilitated due to the potential nano-phase separated and highly ordered block copolymer ultra-structure.

Author

*Polymer Blends; Electro-Optical Effect; Block Copolymers; Synthesis (Chemistry); Nanotechnology*

**20030016570** Norfolk State Univ., Center for Materials Research, VA USA

**Synthesis and Characterization of SF-PPV-I**

Wang, Y., Norfolk State Univ., USA; Fan, Z., Norfolk State Univ., USA; Taft, C., Norfolk State Univ., USA; Sun, S., Norfolk State Univ., USA; [2001]; 1p; In English; CD-ROM contains full text document in PDF format

Contract(s)/Grant(s): NAG3-2289

Report No.(s): NONP-NASA-CD-2002153470; No Copyright; Avail: CASI; C01, CD-ROM; A01, Hardcopy; A01, Microfiche

Conjugated electro-active polymers find their potential applications in developing variety inexpensive and flexible shaped electronic and photonic devices, such as photovoltaic or photo/electro light emitting devices. In many of these opto-electronic polymeric materials, certain electron rich donors and electron deficient acceptors are needed in order to fine-tune the electronic or photonic properties of the desired materials and structures. While many donor type of conjugated polymers have been widely studied and developed in the past decades, there are relatively fewer acceptor type of conjugated polymers have been developed. Key acceptor type conjugated polymers developed so far include C60 and CN-PPV, and each has its limitations. Due to the complexity and diversity of variety future electronic materials and structural needs, alternative and synthetically amenable acceptor conjugated polymers need to be developed. In this paper, we present the synthesis and characterization of a new acceptor conjugated polymer, a sulfone derivatized polyphenylenevinylene "SF-PPV".

Derived from text

*Synthesis (Chemistry); Photovoltaic Effect; Block Copolymers; Donor Materials; Acceptor Materials; Polyphenyls; Characterization*

**20030016571** Norfolk State Univ., Center for Materials Research and Chemistry Dept., VA USA

**Novel High Efficient Organic Photovoltaic Materials: Appendix for Summary of Research, Appendix, 22 Jul. 1999 - 21 Jul. 2002**

Sun, Sam, Norfolk State Univ., USA; [2002]; 80p; In English; CD-ROM contains full text document in PDF format

Contract(s)/Grant(s): NAG3-2289

Report No.(s): NONP-NASA-CD-2002153465; No Copyright; Avail: CASI; C01, CD-ROM; A05, Hardcopy; A01, Microfiche

There are many different kinds of conjugated polymers that may be useful in photovoltaic devices. So far, the most popular and successful conjugated polymers used in photovoltaic devices include poly(1,4-phenylenevinylene)s (PPV), C60 and their derivatives. The discovery of electro-luminescence in PPV has stimulated a great deal of interest in developing "plastic" solid-state semiconductor devices. The overall synthetic methodology for the preparation of PPV can be divided into three main categories: (1) side chain derivatization, (2) precursor approach, and (3) in-situ polymerization. In this project, the first method was adopted. As discussed in project proposal and literatures, the overall efficiency of photovoltaic devices containing conjugated polymers is determined by the materials ability to generate excitons from incoming radiation, and then to separate the charges at donor/acceptor interfaces, and then to transport charges to respective electrodes. Given that effective exciton diffusion range are typical less than 30 nm, unique morphological structures are needed. This need led to several research groups to the idea that interpenetrating or bi-continuous networks of donor (electron donating) and acceptor (electron withdrawing) polymers should give better results. One approach involved the use of functionalized PPV. The attachment of electron withdrawing cyano groups to a PPV forms the CN-PPV, making it a strong electron acceptor. Underivatized PPV is a generally considered a hole-transporting material. Using blends of MEH-PPV, a soluble donor PPV derivative, as a hole transporter and CN-PPV as an electron transporter, a quantum efficiencies of up to 6% was achieved.

Derived from text

*Morphology; Photovoltaic Effect; Conjugation; Polymerization; Chemical Reactions; Cyano Compounds*

**20030016572** Norfolk State Univ., Center for Organic Photonic Materials Research, VA USA

**Conjugated Block Copolymers for Opto-Electronic Functions**

Sun, S., Norfolk State Univ., USA; Fan, Z., Norfolk State Univ., USA; Wang, Y., Norfolk State Univ., USA; Haliburton, J., Norfolk State Univ., USA; Taft, C., Norfolk State Univ., USA; Maaref, S., Norfolk State Univ., USA; Seo, K., Norfolk State Univ., USA;

Bonner, C. E., Norfolk State Univ., USA; [2002]; 2p; In English; CD-ROM contains full text document in PDF format  
Contract(s)/Grant(s): F49620-01-0485; F49620-02-I-0006; NAG3-2289

Report No.(s): NONP-NASA-CD-2002153484; No Copyright; Avail: CASI; C01, CD-ROM; A01, Hardcopy; A01, Microfiche

A novel block copolymer system containing a conjugated donor block (RO-PPV) and a conjugated acceptor block (SF-PPV) coupled by a non-conjugated bridge unit has been synthesized and characterized. While the donor block film has a strong PL emission at around 570 nm, and acceptor block film has a strong PL emission at around 590 nm, the PL emissions of -DBAB-block copolymer films were quenched by over 99%. Preliminary thin film electron microscopy studies revealed certain regular morphological pattern, possibly due to block copolymer microphase separation.

Author

*Block Copolymers; Conjugation; Optoelectronic Devices; Photovoltaic Effect; Acceptor Materials*

**20030018098** Osaka City Univ., Dept. of Physical Electronics and Information, Japan

**Mn(sup 2+) Centers in ZnS:Mn Thin-Film EL Device Active Layer**

Takamichi, Kazuhiro, Osaka City Univ., Japan; Nitta, Atsushi, Osaka City Univ., Japan; Tanaka, Kenji, Osaka City Univ., Japan; Aozasa, Masao, Osaka City Univ., Japan; Memoirs of the Faculty of Engineering, Osaka City University; December 2002; ISSN 0078-6659; Volume 43, pp. 1-5; In English; Copyright; Avail: Issuing Activity

It is very important to understand the state of incorporated Mn(2+) centers to fabricate bright ZnS:Mn thin-film electroluminescent (TFEL) devices. As the concentration of Mn is much less than that of ZnS, it is very difficult to investigate its influence on luminescence. Five kinds of ZnS:Mn active layers with different Mn concentration were fabricated by RF magnetron sputtering method, and X-ray photoelectron spectroscopy (XPS) and Photoluminescent (PL) spectrum were examined to determine Mn 3d orbit level and to decide the preferable weight percentage of Mn. Mn 3d orbit level were 2.6 eV and 4.7 eV below vacuum level, and 0.5 wt. % was most efficient.

Author

*Electroluminescence; Radio Frequencies; Zinc Sulfides; Thin Films; X Ray Spectroscopy*

**20030018411** Nanjing General Hospital, Nanjing, China

**Design and Application of a Circuit for Measuring Frequency and Duty Cycle of Stimulated Bioelectrical Signal**

Tang, Li-Ming, Nanjing General Hospital, China; Chang, Ben-Kang, Nanjing General Hospital, China; Liu, Tie-Bing, Nanjing General Hospital, China; Wu, Min, Nanjing General Hospital, China; Ling, Gang, Nanjing General Hospital, China; Space Medicine and Medical Engineering; December 2002; ISSN 1002-0837; Volume 15, No. 6, pp. 433-436; In Chinese; Copyright; Avail: Issuing Activity

To design a new type of circuit for measuring frequency & duty cycle of stimulated bioelectrical signal for the project of 'the map of neuron-threshold in human brain and its clinical application'. This circuit was designed according to the character of stimulated bioelectrical signals. It was tested and improved and then used in the neuron -threshold stimulator. The circuit was found to be very accurate for measuring frequency and the error for measuring duty cycle was below 0.2%. This circuit is well-designed, simple, easy to use, and can be applied in many systems.

Author

*Bioelectricity; Brain; Circuits; Design Analysis*

## 34

### FLUID MECHANICS AND THERMODYNAMICS

*Includes fluid dynamics and kinematics and all forms of heat transfer; boundary layer flow; hydrodynamics; hydraulics; fluidics; mass transfer and ablation cooling. For related information see also 02 Aerodynamics.*

**20030014706** NASA Glenn Research Center, Cleveland, OH USA

**Fuel Injector Design Optimization for an Annular Scramjet Geometry**

Steffen, Christopher J., Jr., NASA Glenn Research Center, USA; January 2003; 20p; In English; 41st Aerospace Sciences Meeting and Exhibit, 6-9 Jan. 2003, Reno, NV, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Contract(s)/Grant(s): RTOP 708-90-46

Report No.(s): NASA/TM-2003-212094; NAS 1.26:212094; E-13746; AIAA Paper 2003-0651; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A four-parameter, three-level, central composite experiment design has been used to optimize the configuration of an annular scramjet injector geometry using computational fluid dynamics. The computational fluid dynamic solutions played the role of

computer experiments, and response surface methodology was used to capture the simulation results for mixing efficiency and total pressure recovery within the scramjet flowpath. An optimization procedure, based upon the response surface results of mixing efficiency, was used to compare the optimal design configuration against the target efficiency value of 92.5%. The results of three different optimization procedures are presented and all point to the need to look outside the current design space for different injector geometries that can meet or exceed the stated mixing efficiency target.

Author

*Computational Fluid Dynamics; Design Optimization; Fuel Injection; Injectors; Supersonic Combustion Ramjet Engines; Rocket-Based Combined-Cycle Engines*

**20030014736** Minnesota Univ., Minneapolis, MN USA

**Experimental Investigation of Transition to Turbulence as Affected by Passing Wakes *Final Report***

Kaszeta, Richard W., Minnesota Univ., USA; Simon, Terrence W., Minnesota Univ., USA; December 2002; 254p; In English; Original contains color illustrations

Contract(s)/Grant(s): NCC3-652; RTOP 719-10-03; RTOP 708-28-07

Report No.(s): NASA/CR-2002-212104; NAS 1.26:212104; E-12858-1; No Copyright; Avail: CASI; A12, Hardcopy; A03, Microfiche

Experimental results from a study of the effects of passing wakes upon laminar-to-turbulent transition in a low-pressure turbine passage are presented. The test section geometry is designed to simulate the effects of unsteady wakes resulting from rotor-stator interaction upon laminar-to-turbulent transition in turbine blade boundary layers and separated flow regions over suction surfaces. Single-wire, thermal anemometry techniques were used to measure time-resolved and phase-averaged, wall-normal profiles of velocity, turbulence intensity, and intermittency at multiple streamwise locations over the turbine airfoil suction surface. These data are compared to steady state, wake-free data collected in the same geometry to identify the effects of wakes upon laminar-to-turbulent transition. Results are presented for flows with a Reynolds number based on suction surface length and exit velocity of 50,000 and an approach flow turbulence intensity of 2.5 percent. From these data, the effects of passing wakes and associated increased turbulence levels and varying pressure gradients on transition and separation in the near-wall flow are presented. The results show that the wakes affect transition both by virtue of their difference in turbulence level from that of the free-stream but also by virtue of their velocity deficit relative to the freestream velocity, and the concomitant change in angle of attack and temporal pressure gradients. The results of this study seem to support the theory that bypass transition is a response of the near-wall viscous layer to pressure fluctuations imposed upon it from the free-stream flow. The data also show a significant lag between when the wake is present over the surface and when transition begins. The accompanying CD-ROM includes tabulated data, animations, higher resolution plots, and an electronic copy of this report.

Author

*Velocity Measurement; Turbulent Flow; Turbines; Transition Flow; Wakes; Flow Measurement*

**20030014838** Duke Univ., Dept. of Mechanical Engineering and Materials Science, Durham, NC USA

**Modeling of Unsteady Three-Dimensional Flows in Multistage Machines *Interim Report, Apr. 2001 - Sep. 2002***

Hall, Kenneth C., Duke Univ., USA; Pratt, Edmund T., Jr., Duke Univ., USA; January 2003; 41p; In English

Contract(s)/Grant(s): NAG3-2627; RTOP 708-87-23

Report No.(s): NASA/CR-2003-212101; NAS 1.26:212101; E-13754; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Despite many years of development, the accurate and reliable prediction of unsteady aerodynamic forces acting on turbomachinery blades remains less than satisfactory, especially when viewed next to the great success investigators have had in predicting steady flows. Hall and Silkowski (1997) have proposed that one of the main reasons for the discrepancy between theory and experiment and/or industrial experience is that many of the current unsteady aerodynamic theories model a single blade row in an infinitely long duct, ignoring potentially important multistage effects. However, unsteady flows are made up of acoustic, vortical, and entropic waves. These waves provide a mechanism for the rotors and stators of multistage machines to communicate with one another. In other words, wave behavior makes unsteady flows fundamentally a multistage (and three-dimensional) phenomenon. In this research program, we have had as goals (1) the development of computationally efficient computer models of the unsteady aerodynamic response of blade rows embedded in a multistage machine (these models will ultimately be capable of analyzing three-dimensional viscous transonic flows), and (2) the use of these computer codes to study a number of important multistage phenomena.

Author

*Unsteady Flow; Unsteady Aerodynamics; Turbomachinery; Applications Programs (Computers); Three Dimensional Flow; Three Dimensional Models; Computational Fluid Dynamics; Heat Transfer*

**20030014942** NASA Glenn Research Center, Cleveland, OH USA

**Measurements of Shear Lift Force on a Bubble in Channel Flow in Microgravity**

Nahra, Henry K., NASA Glenn Research Center, USA; Motil, Brian J., NASA Glenn Research Center, USA; Skor, Mark, Baldwin-Wallace Coll., USA; January 2003; 16p; In English; 41st Aerospace Sciences Meeting and Exhibit, 6-9 Jan. 2003, Reno, NV, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Contract(s)/Grant(s): RTOP 101-53-01

Report No.(s): NASA/TM-2003-212113; NAS 1.15:212113; E-13756; AIAA Paper 2003-1300; Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche; Distribution as joint owner in the copyright; Distribution as joint owner in the copyright

Under microgravity conditions, the shear lift force acting on bubbles, droplets or solid particles in multiphase flows becomes important because under normal gravity, this hydrodynamic force is masked by buoyancy. This force plays an important role in furnishing the detachment process of bubbles in a setting where a bubble suspension is needed in microgravity. In this work, measurements of the shear lift force acting on a bubble in channel flow are performed. The shear lift force is deduced from the bubble kinematics using scaling and then compared with predictions from models in literature that address different asymptotic and numerical solutions. Basic trajectory calculations are then performed and the results are compared with experimental data of position of the bubble in the channel. A direct comparison of the lateral velocity of the bubbles is also made with the lateral velocity prediction from investigators, whose work addressed the shear lift on a sphere in different two-dimensional shear flows including Poiseuille flow.

Author

*Bubbles; Channel Flow; Drops (Liquids); Microgravity; Numerical Analysis; Lift*

**20030015398** NASA Langley Research Center, Hampton, VA USA

**The Current Status of Unsteady CFD Approaches for Aerodynamic Flow Control**

Carpenter, Mark H., NASA Langley Research Center, USA; Singer, Bart A., NASA Langley Research Center, USA; Yamaleev, Nail, National Academy of Sciences - National Research Council, USA; Vatsa, Veer N., NASA Langley Research Center, USA; Viken, Sally A., NASA Langley Research Center, USA; Atkins, Harold L., NASA Langley Research Center, USA; [2002]; 28p; In English; 1st AIAA Flow Control Conference, 24-26 Jun. 2002, Saint Louis, MI, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA Report No.(s): AIAA Paper 2002-3346; Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche; Distribution as joint owner in the copyright; Distribution as joint owner in the copyright

An overview of the current status of time dependent algorithms is presented. Special attention is given to algorithms used to predict fluid actuator flows, as well as other active and passive flow control devices. Capabilities for the next decade are predicted, and principal impediments to the progress of time-dependent algorithms are identified.

Author

*Unsteady Aerodynamics; Computational Fluid Dynamics; Aerodynamic Characteristics; Time Dependence; Algorithms*

**20030015407** NASA Ames Research Center, Moffett Field, CA USA

**Progress in Unsteady Turbopump Flow Simulations Using Overset Grid Systems**

Kiris, Cetin C., NASA Ames Research Center, USA; Chan, William, NASA Ames Research Center, USA; Kwak, Dochan, NASA Ames Research Center, USA; [2002]; 21p; In English; NASA MSFC 2002 Workshop, 19-21 Nov. 2002, Huntsville, AL, USA; Sponsored by NASA Marshall Space Flight Center, USA; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This viewgraph presentation provides information on unsteady flow simulations for the Second Generation RLV (Reusable Launch Vehicle) baseline turbopump. Three impeller rotations were simulated by using a 34.3 million grid points model. MPI/OpenMP hybrid parallelism and MLP shared memory parallelism has been implemented and benchmarked in INS3D, an incompressible Navier-Stokes solver. For RLV turbopump simulations a speed up of more than 30 times has been obtained. Moving boundary capability is obtained by using the DCF module. Scripting capability from CAD geometry to solution is developed. Unsteady flow simulations for advanced consortium impeller/diffuser by using a 39 million grid points model are currently underway. 1.2 impeller rotations are completed. The fluid/structure coupling is initiated.

Derived from text

*Turbine Pumps; Unsteady Flow; Computational Grids; Impellers; Simulation; Rotation*

**20030015443** Sierra Engineering, Inc., Carson City, NV USA

**Development of GOX/Hydrocarbon Multi-Element Swirl Coaxial Injector Technology**

Johnson, C. W.; Muss, J.; Cheng, G. C.; Davis, R.; Cohn, R. K.; Nov. 26, 2002; 3p; In English

Contract(s)/Grant(s): F04611-01-C-0010; AF Proj. BMDO

Report No.(s): AD-A409407; AFRL-PR-ED-AB-2002-289; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

In developing the advanced liquid rocket engine, injector design is critical to obtaining the dual goals of long engine life as well as providing high-energy release efficiency in the main combustion chamber. Introducing a swirl component in the injector flow can enhance the propellant mixing and thus improve engine performance. Therefore, swirl coaxial injectors, which swirl liquid fuel around a gaseous oxygen core, show promise for the next generation of high performance staged combustion rocket engines utilizing hydrocarbon fuels. Understanding the mixing and combustion characteristics of the swirl coaxial flow provides the insight of optimizing the injector design. A joint effort of Sierra Engineering (Sierra) and the Propulsion Directorate of the Air Force Research Lab (AFRL) was conducted to develop a design methodology, utilizing both high-pressure cold-flow testing and uni-element hot-fire testing, to create a high performing, long life swirl coaxial injector for multi-element combustor use. Several swirl coax injector configurations designed and fabricated by Sierra have been tested at AFRL. The cold-flow tests and numerical simulations have been conducted. The cold flow result provided valuable information of flow characteristics of swirl coaxial injectors. However, there are two important flow features of liquid rocket engines missed from the cold flow test: (1) the effect of combustion on the propellant mixing, and (2) the interaction of multiple injectors. The present work studies the hot flow environment specifically the multiple element swirl coaxial injector. Numerical simulations were performed with a pressure-based computational fluid dynamics (CFD) code, FDNS. CFD results produced loading environments for an ANSYS finite element thermal/structural model. Since the fuels are injected at temperature below its critical temperature, the effect of phase change and chemical reactions needs to be accounted for in the CFD model.

DTIC

*Hydrocarbon Fuels; Injectors; Fuel Injection*

**20030015488** NASA Langley Research Center, Hampton, VA USA

**Improvement of Flow Quality in NAL Chofu Mach 10 Nozzle**

Lacey, John, Aero Systems Engineering, Inc., USA; Inoue, Yasutoshi, National Aerospace Lab., Japan; Higashida, Akio, Mitsubishi Heavy Industries Ltd., Japan; Inoue, Manabu, Mitsubishi Heavy Industries Ltd., Japan; Ishizaka, Kouichi, Mitsubishi Heavy Industries Ltd., Japan; Korte, John J., NASA Langley Research Center, USA; [2002]; 7p; In English; 40th AIAA Aerospace Sciences Meeting and Exhibit, 14-17 Jan. 2002, Reno, NV, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Report No.(s): AIAA Paper 2002-0440; Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche; Distribution as joint owner in the copyright; Distribution as joint owner in the copyright

As a result of CFD analysis and remachining of the nozzle, the flow quality of the Mach 10 Hypersonic Wind Tunnel at NAL Chofu, Japan was improved. The subsequent test results validated the CFD analytical predictions by NASA and MHL.

Author

*Nozzle Flow; Hypersonic Speed; Computational Fluid Dynamics*

**20030015740** Lawrence Livermore National Lab., Livermore, CA USA

**Model Validation of Flow and Dispersion Around a Cube**

Stevens, D. E.; Chan, S. T.; Lee, R. L.; Jan. 20, 2000; In English; This document is color dependent and/or in landscape layout. It is currently available on CD-ROM

Report No.(s): DE2002-792338; UCRL-ID-137241; No Copyright; Avail: National Technical Information Service (NTIS)

This paper compares results for flow over a cube between laboratory experiments and two numerical simulations. One of the simulations is a Reynolds-averaged Navier-Stokes (RANS) calculation, the other a large eddy simulation (LES). Both the structure of the flow and dispersion of a source behind the cube are compared. It was found that both simulations performed well when mean flows are compared.

NTIS

*Cubes (Mathematics); Computational Fluid Dynamics; Navier-Stokes Equation; Large Eddy Simulation*

**20030015741** Lawrence Livermore National Lab., Livermore, CA USA

**Flow Around a Complex Building: Comparisons Between Experimental and Modeled Results**

Callhoun, R.; Chan, S.; Gouveia, F.; Lee, R.; Leone, J.; Nov. 22, 1999; In English; This document is color dependent and/or in landscape layout. It is currently available on CD-ROM

Report No.(s): DE2002-792340; UCRL-ID-137240; No Copyright; Avail: National Technical Information Service (NTIS)

The authors compare the results of computer simulated flow fields around building 170 (B170) at Lawrence Livermore National Laboratory (LLNL) with field measurements. This is the first stage of a larger effort to assess the ability of computational fluid dynamics (CFD) models to predict atmospheric dispersion scenarios around building complexes. At this stage, the focus is on accurate simulation of the velocity field. Two types of simulations were performed: predictive and post-experiment. The

purpose of the predictive runs was primarily to provide initial guidance for the planning of the experiment. by developing an approximate understanding of the major features of the flow field, they were able to more effectively deploy the sensors.

NTIS

*Flow Distribution; Velocity Distribution*

**20030015755** NASA Langley Research Center, Hampton, VA USA

**Stochastic Modeling of Laminar-Turbulent Transition**

Rubinstein, Robert, NASA Langley Research Center, USA; Choudhari, Meelan, NASA Langley Research Center, USA; [2002]; 10p; In English; 23rd International Council of the Aeronautical Sciences, 8-13 Sep. 2002, Toronto, Canada; Sponsored by International Council of the Aeronautical Sciences, Unknown; Original contains color illustrations

Report No.(s): ICAS-2002; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Stochastic versions of stability equations are developed in order to develop integrated models of transition and turbulence and to understand the effects of uncertain initial conditions on disturbance growth. Stochastic forms of the resonant triad equations, a high Reynolds number asymptotic theory, and the parabolized stability equations are developed.

Author

*Stochastic Processes; Models; Laminar Flow; Turbulent Boundary Layer; Boundary Layer Transition*

**20030015760** NASA Johnson Space Center, Houston, TX USA

**Bubble Measuring Instrument and Method**

Kline-Schoder, Robert, Inventor, NASA Johnson Space Center, USA; Magari, Patrick J., Inventor, NASA Johnson Space Center, USA; Oct. 01, 2002; 18p; In English; Division of US-Patent-Appl-SN-498440, filed 4 Feb. 2000

Patent Info.: Filed 26 Mar. 2002; NASA-Case-MS-C-22980-4; US-Patent-6,457,346; US-Patent-Appl-SN-113642; US-Patent-Appl-SN-498440; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Method and apparatus are provided for a non-invasive bubble measuring instrument operable for detecting, distinguishing, and counting gaseous embolisms such as bubbles over a selectable range of bubble sizes of interest. A selected measurement volume in which bubbles may be detected is insonified by two distinct frequencies from a pump transducer and an image transducer, respectively. The image transducer frequency is much higher than the pump transducer frequency. The relatively low-frequency pump signal is used to excite bubbles to resonate at a frequency related to their diameter. The image transducer is operated in a pulse-echo mode at a controllable repetition rate that transmits bursts of high-frequency ultrasonic signal to the measurement volume in which bubbles may be detected and then receives the echo. From the echo or received signal, a beat signal related to the repetition rate may be extracted and used to indicate the presence or absence of a resonant bubble. In a preferred embodiment, software control maintains the beat signal at a preselected frequency while varying the pump transducer frequency to excite bubbles of different diameters to resonate depending on the range of bubble diameters selected for investigation.

Official Gazette of the U.S. Patent and Trademark Office

*Bubbles; Embolisms; Measuring Instruments; Image Transducers*

**20030015766** Wichita State Univ., Inst. for Aviation Research, Wichita, KS USA

**Numerical Simulation of Compressible Viscous Magneto-Hydrodynamics Equations with Chemical Kinetics Final Report, 1 Oct. 1998-30 Sep. 2002**

Agarwal, Ramesh K.; Sep. 2002; 7p; In English

Contract(s)/Grant(s): F49620-99-1-0005

Report No.(s): AD-A409344; AFRL-SR-AR-TR-02-0449; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Most of the objectives of this research project have been achieved. In this first phase of the AFOSR grant (1 October 1998 - 30 September 2002), the principal investigator and his students have developed a 2-D unsteady compressible viscous magnetohydrodynamic code designated MHD2D which has been validated for 2-D internal and external flow & The code solves the coupled MHD equations (mass, momentum and energy equations of fluid flow including MHD effects (Lorentz force and Joule heating), magnetic induction equations and Maxwell equations) and includes an equilibrium air model for re gas effects, a finite-rate chemical kinetics model for dissociated air, several electrical conductivity models and a bi-temperature model. I-his code has been employed to investigate the concept of supersonic drag and heat transfer reduction by modification/dissipation of shock waves in the presence of strong magnetic fields. A series of numerical experiments for blunt body flows and scramjet inlet flow fields have been conducted by varying the Mach number, Reynolds number, degree of ionization of the air plasma and the

intensity of the magnetic field to understand the physics of the phenomena and its potential for supersonic drag reduction in practical applications.

DTIC

*Magnetohydrodynamics; Magnetic Induction; Supersonic Combustion Ramjet Engines*

**20030015784** Universitaet der Bundeswehr, Fachbereich Maschinenbau, Hamburg Germany

**Stationary and Non-Stationary Behavior of Two Coupled Heat Exchangers with Circuitous Fluid Flow** *Stationaeres und instationaeres Verhalten von zwei gekoppelten Waermeuebertragern mit umlaufendem Fluidstrom*

NaRanong, Chakkrit; Nov. 2001; 178p; In English

Report No.(s): AD-A409373; No Copyright; Avail: CASI; A09, Hardcopy; A02, Microfiche

This dissertation covers the following subjects: the optimization of stationary usage; methods of approach in the testing of non-stationary behavior, including basic equations; calculation of non-stationary behavior with the Laplace transformation; calculation of non-stationary behavior using the Finite Difference method; examples of non-stationary behavior. The final chapter is a summary of the test results, divided categorically: stationary terminal state; differential equations for the calculation of fields of dimensionless temperature fluctuations; the solution in the frequency field, and then, once more, the Finite Difference equations previously employed. The results lead to an inquiry regarding their plausibility and applicability to other forms of currents.

DTIC

*Fluid Flow; Laplace Transformation*

**20030015801** Sierra Engineering, Inc., Carson City, NV USA

**Computational Analysis of High Aspect Ratio Cooling Channels**

Gotchy, Matt; Ferrenberg, Al; Johnson, Curtis; Greisen, Dan; Dec. 03, 2002; 3p; In English; Pres. at AIAA/ASME/SAE/ASEE Joint Propulsion Conference, 20 Jul 2003

Contract(s)/Grant(s): F04611-00-C-0009; Proj-3005

Report No.(s): AD-A409457; AFRL-PR-ED-AB-2002-293; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Many parameters can have an effect of the cooling ability and pressure drop performance in high aspect ratio cooling channels (HARCC) However few studies have attempted to quantify these effects In the present study Fluent was used to solve the three-dimensional fluid dynamics and conjugate heat transfer within cooling channels of a variety of aspect ratios. The objective of these studies was to explore the potential impact of the asymmetric heating in a HARCC and to identify parameters which can have a significant effect upon the performance of High Aspect Ratio Cooling channels in order to design an experimental facility which will allow for the validation of the flow phenomenology.

DTIC

*Cooling; Channels*

**20030015803** NASA Johnson Space Center, Houston, TX USA

**Bubble Measuring Instrument and Method**

Kline-Schoder, Robert, Inventor, NASA Johnson Space Center, USA; Magari, Patrick J., Inventor, NASA Johnson Space Center, USA; Oct. 22, 2002; 19p; In English; Division of US-Patent-Appl-SN-498440, filed 4 Feb. 2000

Patent Info.: Filed 26 Mar. 2002; NASA-Case-MS-C-22980-5; US-Patent-6,467,331; US-Patent-Appl-SN-113646; US-Patent-Appl-SN-498440; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Method and apparatus are provided for a non-invasive bubble measuring instrument operable for detecting, distinguishing, and counting gaseous embolisms such as bubbles over a selectable range of bubble sizes of interest. A selected measurement volume in which bubbles may be detected is insonified by two distinct frequencies from a pump transducer and an image transducer, respectively. The image transducer frequency is much higher than the pump transducer frequency. The relatively low-frequency pump signal is used to excite bubbles to resonate at a frequency related to their diameter. The image transducer is operated in a pulse-echo mode at a controllable repetition rate that transmits bursts of high-frequency ultrasonic signal to the measurement volume in which bubbles may be detected and then receives the echo. From the echo or received signal, a beat signal related to the repetition rate may be extracted and used to indicate the presence or absence of a resonant bubble. In a preferred embodiment, software control maintains the beat signal at a preselected frequency while varying the pump transducer frequency to excite bubbles of different diameters to resonate depending on the range of bubble diameters selected for investigation.

Author

*Bubbles; Measuring Instruments; Detection; Counting; Size Determination*

**20030015816** Air Force Inst. of Tech., School of Engineering and Management, Wright-Patterson AFB, OH USA

**Use of Dimples to Suppress Boundary Layer Separation on a Low Pressure Turbine Blade**

Rouser, Kurt P.; Dec. 2002; 202p; In English; Original contains color images

Report No.(s): AD-A409462; AFIT/GAE/ENY/02-13; No Copyright; Avail: Defense Technical Information Center (DTIC)

Flow separation on a low pressure turbine blade is explored at Reynolds numbers of 25k, 45k and 100k, Experimental data is collected in a low-speed, draw-down wind tunnel using a cascade of eight Pak-B blades, Flow is examined from measurements of blade surface pressures, boundary layer parameters, exit velocities, and total pressure losses across the blade, Two recessed dimple shapes are assessed for suppressing flow separation and associated losses, One dimple is spherical, and the second is asymmetric, formed from a full dimple spanwise half-filled, A single row of each dimple shape is tested at 50%, 55% and 65% axial chord, Symmetric dimples reduce separation losses by as much as 28%, while asymmetric dimples reduce losses by as much as 23%, A complementary three-dimensional computational study is conducted to visualize local flow structure, Computational analysis uses Gridgen v13,3 as a mesh generator, Fluent v6,0 as a flow solver and FIELDVVIEW - v8,0 for graphic display and analysis, Computational results for Pak-B blades at a Reynolds number of 25k indicate that both dimple shapes cause a span-wise vortex to rollup within the dimple and provide a localized pressure drop,

DTIC

*Turbine Blades; Boundary Layer Separation; Separated Flow*

**20030015839** Raytheon STX Corp., USA

**Molecular Models for Reacting Flows: Should Variable Collision Diameters for Internal States be Used in DSMC Simulations?**

Wysong, Ingrid J.; Apr. 28, 1998; 4p; In English

Contract(s)/Grant(s): AF Proj. 2308

Report No.(s): AD-A409513; AFRL-PR-ED-TP-1998-073; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The formulation of expressions for transport properties in nonequilibrium flows has been an active research field for many years. One powerful feature of particle simulation methods such as direct simulation Monte Carlo (DSMC) is that they do not require transport properties as input parameters. Rather, given a sufficiently realistic model of the intermolecular potential and energy transfer, transport properties emerge naturally as a statistical consequence of many collisions along with boundary conditions. Thus, a physically realistic yet computationally tractable model for molecular collisions is of primary importance for DSMC methods.

DTIC

*Intermolecular Forces; Molecular Collisions; Monte Carlo Method; Computerized Simulation; Reacting Flow*

**20030015844** Nu-Modeling, Inc., Goettingen, Germany

**Numerical Prediction of the Hypersonic Boundary-Layer Over a Row of Microcavities Final Report, 12 Jun. 2001-12 Jun 2002**

Theofilis, Vassilios; Sep. 2002; 34p; In English; Original contains color images

Contract(s)/Grant(s): F61775-01-WE049

Report No.(s): AD-A409528; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report results from tasking Nu-Modeling, Inc. as follows: the contractor will perform detailed numerical predictions of the flowfield in the neighborhood of the microcavities that are embedded in wall-coatings. The key deliverable of the proposed work will be the ability to put forward an improved integral condition to replace what is used in the current theoretical approach. This will be determined numerically at each of the parameters of the problem. The numerical effort required for the solution of the problem at a single value of each of the parameters involved limits to subset of the (M, Re, m, d, d/D, d/s) parameter space that can be investigated within the available year. It is intended to approximate existing analytic results of Fedorov first, at a single set of parameters, by imposing his pressure boundary condition at the lips of the microcavities (i.e. taking  $D=0$ ). The effect of nonzero values of this parameter will then be examined, keeping all other parameters in the problem constant. Subsequently, the effect of d, and 5 will be investigated, at constant D and 2(d+s). In all D1 0 cases to be studied, integral boundary conditions will be provided to the parties involved in the project. Progress of the proposed research will be monitored by means of one intermediate and one final report.

DTIC

*Boundary Layers; Flow Distribution; Hypersonic Flow; Mathematical Models; Cavities*

20030015855 Poitiers Univ., France

**The Mitral Valve Prolapsus: Quantification of the Regurgitation Flow Rate by Experimental Time-Dependant PIV**

Billy, F.; Coisne, D.; Sanchez, L.; Perrault, R.; Oct. 25, 2001; 3p; In English; Papers from the 23rd Annual International Conference of the IEEE engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on CD-ROM

Report No.(s): AD-A409547; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Color Doppler is routinely used for visualisation of intra cardiac flows and quantification of valvular heart disease, Nevertheless the 2D visualization of a complex 3D phenomenon is the major limitation of this technique, In particular, in clinical setting, the flow rate calculation upstream a regurgitant orifice (i.e, mitral valve insufficiency), assumes that the velocity field in the convergent region have hemispheric shapes and introduce miscalculation specially in case of prolaps regurgitant orifices, The main objective of this study was to characterize the dynamic 3D velocity field of the convergent region upstream a prolaps model of regurgitant orifice based on 2D time dependent PIV reconstruction.

DTIC

*Flow Velocity; Heart Function; Heart Valves; Time Dependence; Cardiology; Particle Image Velocimetry*

20030016535 Fluor Daniel Hanford, Inc., Richland, WA USA

**ARROW(Version 2)-Commercial Software Validation and Configuration Control**

Heard, F. J.; 2000; 140p; In English

Report No.(s): DE2002-801359; SNF-5331; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

ARROW (Version 2), a compressible flow piping network modeling and analysis computer program from Applied Flow Technology, was installed for use at the U.S. Department of Energy Hanford Site near Richland, Washington. A series of sample problems were performed to validate the software and confirm proper installation. The sample problems are compared to published results.

NTIS

*Fluid Flow; Compressible Flow; Proving; Configuration Management*

20030016536 CH2M/Hill, Inc., Bellevue, WA USA

**Guidance for Flow Computer Setup on the Jet Pump Motor Recirculation Flow Line**

Templeton, A. M.; 2000; 14p; In English

Report No.(s): DE2002-801354; RPP-5870; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

This document provides guidance for setting up and operating the flow computer on the PIC skids. The flow computer monitors the flow for the jet pump recirculation line.

NTIS

*Airborne/Spaceborne Computers; Computational Fluid Dynamics; Circulation*

20030016545 Instituto Nacional de Pesquisas Espaciais, Sao Jose dos Campos, Brazil

**Bidimensional Modeling for Incompressible Viscous Flow with Unstructured Grid Circumcenter Based Approach  
*Modelagem Bidimensional de Escoamentos Viscosos Incompressiveis com Malhas Nao Estruturadas Utilizando a Abordagem Baseada no Circuncentro***

Fazenda, Alvaro Luiz, Instituto Nacional de Pesquisas Espaciais, Brazil; [2002]; 166p; In Portuguese

Report No.(s): INPE-8980-TDI/811; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

A possible approach for modeling two-dimensional convection-diffusion problems in a Cell-Centered scheme with unstructured triangular grid is the use of the Circumcenter, that is the center of the circumference that pass through the vertices of the triangular volume. This point is used to calculate all variables involved in the numerical simulation, and a Finite Volume Method was use to discretize the equations of an Incompressible Viscous Flow. This work analyzes classical problems of bidimensional flow like the inlet region of a Poiseuille flow, lid-driven cavity, backward-facing step and free convection with Boussinesq approximation. The application of the method has showed to be a simple and flexible scheme, and the results fits the analytical, experimental or numeric data presents in the literature.

Author

*Backward Facing Steps; Boussinesq Approximation; Two Dimensional Models; Viscous Flow; Finite Volume Method; Cavities*

20030016552 NASA Marshall Space Flight Center, Huntsville, AL USA

**Analysis of X-33 Linear Aerospike Plume Induced Base-Heating Environment During Power-Pack Out**

Wang, Ten-See, NASA Marshall Space Flight Center, USA; Williams, Robert, NASA Marshall Space Flight Center, USA;

Droege, Alan, NASA Marshall Space Flight Center, USA; Dagnostino, Mark, NASA Marshall Space Flight Center, USA; Lee, Young-Ching, NASA Marshall Space Flight Center, USA; Douglas, Stan, NASA Marshall Space Flight Center, USA; [2001]; 20p; In English; NASA/MSFC Fluids Workshop, 4-5 Apr. 2001, Huntsville, AL, USA; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The objectives of this viewgraph presentation are to predict the following: (1) dual-engine base-heating at 57% PL at sea level, and (2) dual-engine base-heating during PPO at three ascent abort trajectories. A systematically anchored computational fluid dynamics and heat transfer three-dimensional transfer simulation is being used to study the effect of reduced power levels on base-heating environments during sea level testing and during PPO. Preliminary results show the following: (1) convective heating is higher for the 57% PL than for 100% PL on most of the pillows and flex seals during sea level testing; and (2) convective heating on pillows and flex seals on the 'off' engine side is higher than that on the 'on' engine side.

Derived from text

*Computational Fluid Dynamics; Convective Heat Transfer; X-33 Reusable Launch Vehicle; Computerized Simulation; Three Dimensional Models*

**20030016668** NASA Glenn Research Center, Cleveland, OH USA

**Probabilistic Evaluation of Blade Impact Damage**

Chamis, C. C., NASA Glenn Research Center, USA; Abumeri, G. H., QSS Group, Inc., USA; January 2003; 32p; In English; 2000 Air Force Structural Integrity Program, 5-7 Dec. 2000, San Antonio, TX, USA; Sponsored by Department of the Air Force, USA; Original contains color illustrations

Contract(s)/Grant(s): RTOP 708-48-11

Report No.(s): NASA/TM-2003-212080; NAS 1.15:212080; E-13733; Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche; Distribution as joint owner in the copyright; Distribution as joint owner in the copyright

The response to high velocity impact of a composite blade is probabilistically evaluated. The evaluation is focused on quantifying probabilistically the effects of uncertainties (scatter) in the variables that describe the impact, the blade make-up (geometry and material), the blade response (displacements, strains, stresses, frequencies), the blade residual strength after impact, and the blade damage tolerance. The results of probabilistic evaluations results are in terms of probability cumulative distribution functions and probabilistic sensitivities. Results show that the blade has relatively low damage tolerance at 0.999 probability of structural failure and substantial at 0.01 probability.

Author

*Probability Distribution Functions; Structural Failure; Damage Assessment; Computerized Simulation; Polymer Matrix Composites; Impact Tolerances; Impact Damage*

**20030016684** NASA Glenn Research Center, Cleveland, OH USA

**Preliminary Results of a Microgravity Investigation to Measure Net Charge on Granular Materials**

Green, Robert D., NASA Glenn Research Center, USA; Myers, Jerry G., NASA Glenn Research Center, USA; Hansen, Bonnie L., Saint Louis Univ., USA; January 2003; 16p; In English; 41st Aerospace Sciences Meeting and Exhibit, 6-9 Jan. 2003, Reno, NV, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA; Original contains color illustrations

Contract(s)/Grant(s): RTOP 101-53-01

Report No.(s): NASA/TM-2003-212109; NAS 1.15:212109; E-13760; AIAA Paper 2003-1304; Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche; Distribution as joint owner in the copyright; Distribution as joint owner in the copyright

Accurate characterization of the electrostatic charge on granular materials has typically been limited to materials with diameters on the order of 10 microns and below due to high settling velocities of larger particles. High settling velocities limit both the time and the acceptable uncertainty with which a measurement can be made. A prototype device has been developed at NASA Glenn Research Center (GRC) to measure coulombic charge on individual particles of granular materials that are 50 to 500 microns in diameter. This device, a novel extension of Millikan's classic oil drop experiment, utilizes the NASA GRC 2.2 second drop tower to extend the range of electrostatic charge measurements to accommodate moderate size granular materials. A dielectric material with a nominal grain diameter between 1.06 and 250 microns was tribocharged using a dry gas jet, suspended in a 5x10x10 cm enclosure during a 2.2 second period of microgravity and exposed to a known electric field. The response was recorded on video and post processed to allow tracking of individual particles. By determining the particle trajectory and velocity, estimates of the coulombic charge were made. Over 30 drops were performed using this technique and the analysis showed that first order approximations of coulombic charge could successfully be obtained, with the mean charge of 3.4E-14 coulombs

measured for F-75 Ottawa quartz sand. Additionally, the measured charge showed a near-Gaussian distribution, with a standard deviation of  $2.14 \times 10^{-14}$  coulombs.

Author

*Dielectrics; Electrostatic Charge; Granular Materials; Microgravity; Stokes Law (Fluid Mechanics); Gravitational Effects*

**20030017834** Eloret Corp., Moffett Field, CA USA

**An Interface for Specifying Rigid-Body Motions for CFD Applications**

Murman, Scott M., Eloret Corp., USA; Chan, William, NASA Ames Research Center, USA; Aftosmis, Michael, NASA Ames Research Center, USA; Meakin, Robert L., Army Aviation and Missile Command, USA; Jan. 09, 2003; 14p; In English; 41st AIAA Aerospace Sciences Meeting, 6-9 Jan. 2003, Reno, NV, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Contract(s)/Grant(s): RTOP 704-40-21

Report No.(s): AIAA Paper 2003-1237; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

An interface for specifying rigid-body motions for CFD applications is presented. This interface provides a means of describing a component hierarchy in a geometric configuration, as well as the motion (prescribed or six-degree-of-freedom) associated with any component. The interface consists of a general set of datatypes, along with rules for their interaction, and is designed to be flexible in order to evolve as future needs dictate. The specification is currently implemented with an XML file format which is portable across platforms and applications. The motion specification is capable of describing general rigid body motions, and eliminates the need to write and compile new code within the application software for each dynamic configuration, allowing client software to automate dynamic simulations. The interface is integrated with a GUI tool which allows rigid body motions to be prescribed and verified interactively, promoting access to non-expert users. Illustrative examples, as well as the raw XML source of the file specifications, are included.

Author

*Graphical User Interface; Computational Fluid Dynamics; Rigid Structures; Applications Programs (Computers)*

## 35

### INSTRUMENTATION AND PHOTOGRAPHY

*Includes remote sensors; measuring instruments and gauges; detectors; cameras and photographic supplies; and holography. For aerial photography see 43 Earth Resources and Remote Sensing. For related information see also 06 Avionics and Aircraft Instrumentation; and 19 Spacecraft Instrumentation.*

**20030014732** NASA Langley Research Center, Hampton, VA USA

**Nanomanipulation and Lithography for Carbon Nanotube Based Nondestructive Evaluation Sensor Development**

Wincheski, Buzz, NASA Langley Research Center, USA; Smits, Jan, Lockheed Martin Engineering and Science Services, USA; Namkung, Min, NASA Langley Research Center, USA; Ingram, JoAnne, Swales Aerospace, USA; Watkins, Neal, Swales Aerospace, USA; Jordan, Jeffrey D., NASA Langley Research Center, USA; Louie, Richard, Pacific Lutheran Univ., USA; [2002]; 4p; In English; 2002 SEM Annual Conference and Expo Experimental and Applied Mech., 10-12 Jun. 2002, Milwaukee, WI, USA; Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Distribution as joint owner in the copyright; Distribution as joint owner in the copyright

Carbon nanotubes (CNTs) offer great potential for advanced sensor development due to the unique electronic transport properties of the material. However, a significant obstacle to the realization of practical CNT devices is the formation of reliable and reproducible CNT to metallic contacts. In this work, scanning probe techniques are explored for both fabrication of metallic junctions and positioning of singlewalled CNTs across these junctions. The use of a haptic force feedback interface to a scanning probe microscope is used to enable movement of nanotubes over micron length scales with nanometer precision. In this case, imaging of the surface is performed with light or intermittent contact to the surface. Increased tip-to-sample interaction forces are then applied to either create junctions or position CNTs. The effect of functionalization of substrate surfaces on the movement and tribology of the materials is also studied. The application of these techniques to the fabrication of CNT-based sensors for nondestructive evaluation applications is discussed.

Author

*Carbon Nanotubes; Lithography; Nondestructive Tests; Imaging Techniques; Transport Properties; Nanotubes*

**20030014823** NASA Glenn Research Center, Cleveland, OH USA

**Damage Detection Using Holography and Interferometry**

Decker, Arthur J., NASA Glenn Research Center, USA; January 2003; 32p; In English; Original contains color illustrations  
Contract(s)/Grant(s): RTOP 323-71-00

Report No.(s): NASA/TM-2003-212078; NAS 1.15:212078; E-13729; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper reviews classical approaches to damage detection using laser holography and interferometry. The paper then details the modern uses of electronic holography and neural-net-processed characteristic patterns to detect structural damage. The design of the neural networks and the preparation of the training sets are discussed. The use of a technique to optimize the training sets, called folding, is explained. Then a training procedure is detailed that uses the holography-measured vibration modes of the undamaged structures to impart damage-detection sensitivity to the neural networks. The inspections of an optical strain gauge mounting plate and an International Space Station cold plate are presented as examples.

Author

*Damage; Holography; Laser Interferometry; Neural Nets; Nondestructive Tests; Structural Analysis*

**20030014909** Lawrence Livermore National Lab., Energetic Materials Center, Livermore, CA USA

**Carbon Resistor Pressure Gauge Calibration at Stresses up to 1 GPa**

Vandersall, Kevin S., Lawrence Livermore National Lab., USA; Niles, Angela M., Lawrence Livermore National Lab., USA; Greenwood, Daniel W., Lawrence Livermore National Lab., USA; Cunningham, Bruce, Lawrence Livermore National Lab., USA; Garcia, Frank, Lawrence Livermore National Lab., USA; Forbes, Jerry W., Lawrence Livermore National Lab., USA; 20th JANNAF Propulsion Systems Hazards Subcommittee Meeting; April 2002; Volume 1, pp. 237-243; In English; Also announced as 20030014891

Contract(s)/Grant(s): W-7405-eng-48; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC

Calibration of the 470-Ohm carbon resistor gauge is desired in the low stress region up to 1 GPa. A split-Hopkinson pressure bar, drop tower apparatus, gas pressure chamber, and gas gun have been used to perform the calibration experiments. The gauge behavior at elevated temperature was also investigated by heating the resistors to 200 C at atmospheric pressure while observing the resistance change. The motivation for this calibration work arises from the desire to increase the number of data points in the low stress regime to better establish the accuracy and precision of the gauge. Details of the various calibration arrangements and the results are discussed and compared to calibration curves fit to previously published calibration data. It was found that in most cases, the data from this work fit the calibration curves rather well.

Author

*Carbon; Gas Pressure; High Temperature; Measuring Instruments; Pressure Chambers; Resistors*

**20030015434** Northwestern Univ., Center for Quantum Devices, Evanston, IL USA

**Uncooled Photon Detectors for IR Imaging Final Report, May 1999-Nov. 2002**

Razeghi, M.; Mohseni, H.; Wei, Y.; Gin, A.; Bae, J.; Dec. 2002; 61p; In English

Contract(s)/Grant(s): N00014-99-1-0630

Report No.(s): AD-A409419; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Throughout the comprehensive research in the past three years, the unique properties of Type II InAs/GaSb heterojunctions were utilized for the realization of novel uncooled infrared photodetectors with higher operating temperature, detectivity and uniformity than the commonly available infrared detectors.

DTIC

*Infrared Detectors; Photometers*

**20030015730** NASA Langley Research Center, Hampton, VA USA

**The Statistics of Visual Representation**

Jobson, Daniel J., NASA Langley Research Center, USA; Rahman, Zia-Ur, College of William and Mary, USA; Woodell, Glenn A., NASA Langley Research Center, USA; [2002]; 11p; In English; SPIE's Aerosense 2002 Symposium, 1-5 Apr. 2002, Orlando, FL, USA; Sponsored by International Society for Optical Engineering, USA; Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche; Distribution as joint owner in the copyright; Distribution as joint owner in the copyright

The experience of retinex image processing has prompted us to reconsider fundamental aspects of imaging and image processing. Foremost is the idea that a good visual representation requires a non-linear transformation of the recorded (approximately linear) image data. Further, this transformation appears to converge on a specific distribution. Here we investigate

the connection between numerical and visual phenomena. Specifically the questions explored are: (1) Is there a well-defined consistent statistical character associated with good visual representations? (2) Does there exist an ideal visual image? and (3) what are its statistical properties?

Author

*Image Processing; Visual Perception; Statistical Analysis; Optimization; Visual Fields*

**20030015762** NASA Johnson Space Center, Houston, TX USA

**Method for Locating a Concealed Object**

Arndt, G. Dickey, Inventor, NASA Johnson Space Center, USA; Carl, James R., Inventor, NASA Johnson Space Center, USA; Byerly, Kent A., Inventor, NASA Johnson Space Center, USA; Ngo, Phong H., Inventor, NASA Johnson Space Center, USA; Stolarczyk, Larry G., Inventor, NASA Johnson Space Center, USA; Dec. 31, 2002; 18p; In English

Patent Info.: Filed 2 Apr. 2001; NASA-Case-MSC-22839-1; US-Patent-6,501,414; US-Patent-Appl-SN-826402; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Apparatus and methods are disclosed for detecting anomalies in microwave penetrable material that may be used for locating plastic mines or pipes underneath the ground. A transmitter is positioned at a plurality of different positions above the ground. A microwave signal is transmitted that is stepped over a plurality of frequencies. At each position, a plurality of reflections are received corresponding to each of the plurality of frequencies that were transmitted. A complex target vector may be produced at each position that contains complex values corresponding to magnitude, phase, and time delay for each of the plurality of reflections received at that location. A complex reference data vector may be produced, either based on predetermined values or based on data from the received plurality of reflections. A comparison is made between the complex target vector and the complex reference data vector to produce a channel vector. In one embodiment, an operator may be applied to the channel vector such as a complex filter matrix or to add a complex conjugate. A response signal is produced and anomalies are detected by variations in the response signal with respect to the plurality of positions.

Official Gazette of the U.S. Patent and Trademark Office

*Microwaves; Position (Location); Equipment; Anomalies*

**20030015776** Alphatech, Inc., Burlington, MA USA

**Multi-Target Tracking with Unattended Ground Sensors (UGS) Data**

Coraluppi, Stefano; Carthel, Craig; Mallick, Mahendra; Oct. 2001; 11p; In English; Original contains color illustrations; See also ADM201471, Papers from the Meeting of the MSS Specialty Group on Battlefield Acoustic and Seismic Sensing, Magnetic and Electric Field Sensors (2001) Held in Applied Physics Lab, Johns Hopkins Univ, Laurel, MD on 24-26 Oct. 2001, volume 2  
Contract(s)/Grant(s): F49620-98-C-0010

Report No.(s): AD-A409361; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper studies the performance of an Extended Kalman Filter/Multi-Hypothesis Tracking (EKF/MHT) tracking with data from seismic and acoustic sensors. We study the impact of tracking performance of the number, placement, and detection threshold associated with these sensors. Our algorithm scales well as the number of sensors increases, indicating its suitability for processing data sets associated with large numbers of unattended ground sensors.

DTIC

*Signal Detectors; Data Acquisition; Tracking (Position)*

**20030015777** BAE Systems, Information and Electronics Warfare Systems, Nashua, NH USA

**Node Placement Guidelines for Distributed Ground Sensor Systems**

Haney, Philip J.; Blatt, Stephen R.; Oct. 2001; 11p; In English; Original contains color illustrations; See also ADM201471, Papers from the Meeting of the MSS Specialty Group on Battlefield Acoustic and Seismic Sensing, Magnetic and Electric Field Sensors (2001) Held in Applied Physics Lab, Johns Hopkins Univ, Laurel, MD on 24-26 Oct. 2001, volume 2

Report No.(s): AD-A409362; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A simulation tool has been developed for the purpose of performing trade studies between data fusion/tracking algorithms and sensor node configurations for distributed sensor system applications. The simulation tool allows the user to control the number and configuration of nodes within a given sensor field in order to analyze system performance as a function of sensor node placement. Simulation results indicate that the proper placement of sensor nodes within a given field is capable of providing significant improvements in system performance. It is anticipated that the simulation tool developed for this work will be used to assist in the sensor node placement for future field tests, exercises and operational scenarios.

DTIC

*Systems Simulation; Multisensor Fusion; Nodes (Standing Waves)*

**20030015794** Cleveland State Univ., Cleveland, OH USA

**Ultrasonic Scanner Control and Data Acquisition Final Report, 7 Nov. 1997 - 31 Dec. 2002**

Hemann, John, Cleveland State Univ., USA; [2002]; 3p; In English

Contract(s)/Grant(s): NCC3-581; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The research accomplishments under this grant were very extensive in the areas of ULTRASONIC SCANNER CONTROL AND DATA ACQUISITION. Rather than try to summarize all this research I have enclosed research papers and reports which were completed with the funding provided by the grant. These papers and reports are listed below:

Author

*Data Acquisition; Ultrasonic Scanners; Control; Research*

**20030015829** Michigan Univ., Dept. of Atmospheric Ocean and Space Sciences, Ann Arbor, MI USA

**Exploration of New Technologies and Novel Designs to Improve X-ray Framing Camera Performance Final Report, 20 Apr. 2001-19 Oct. 2002**

Drake, R. P.; Nov. 01, 2002; 5p; In English

Contract(s)/Grant(s): N00173-01-1-G909; Proj-F004612

Report No.(s): AD-A409491; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

We have developed and activated a facility for steady-state x-ray characterization of microchannel plates, framing cameras, and related components. We have completed a vacuum system with a Manson-type x-ray source. This required experience with and upgrading of the source in order to make it routinely operable. At this time we are able to operate it routinely and we have written manuals for its operation and maintenance by students working in our laboratory environment. The system includes an absolutely calibrated vacuum photodiode for x-ray flux measurements.

DTIC

*Framing Cameras; Technologies; Microchannel Plates; X Ray Sources*

**20030016602** Polytechnic Univ., Brooklyn, NY USA

**Micro-Optical Distributed Sensors for Aero Propulsion Applications Final Report**

Arnold, S., Polytechnic Univ., USA; Otugen, V., Polytechnic Univ., USA; January 2003; 18p; In English; Original contains color illustrations

Contract(s)/Grant(s): NAG3-2679; RTOP 708-87-23

Report No.(s): NASA/CR-2003-212100; NAS 1.26:212100; E-13753; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The objective of this research is to develop micro-opto-mechanical system (MOMS)-based sensors for time- and space-resolved measurements of flow properties in aerodynamics applications. The measurement technique we propose uses optical resonances in dielectric micro-spheres that can be excited by radiation tunneling from optical fibers. It exploits the tunneling-induced and morphology-dependent shifts in the resonant frequencies. The shift in the resonant frequency is dependent on the size, shape, and index of refraction of the micro-sphere. A physical change in the environment surrounding a micro-bead can change one or more of these properties of the sphere thereby causing a shift in frequency of resonance. The change of the resonance frequency can be detected with high resolution by scanning a frequency-tunable laser that is coupled into the fiber and observing the transmission spectrum at the output of the fiber. It is expected that, in the future, the measurement concept will lead to a system of distributed micro-sensors providing spatial data resolved in time and space. The present project focuses on the development and demonstration of temperature sensors using the morphology-dependent optical resonances although in the latter part of the work, we will also develop a pressure sensor. During the period covered in this report, the optical and electronic equipment necessary for the experimental work was assembled and the experimental setup was designed for the single sensor temperature measurements. Software was developed for real-time tracking of the optical resonance shifts. Some preliminary experiments were also carried out to detect temperature using a single bead in a water bath.

Author

*Optical Measuring Instruments; Microinstrumentation; Aerospace Systems; Flow Characteristics; Temperature Sensors*

**20030016692** California Inst. of Tech., Submillimeter Observatory, Pasadena, CA USA

**The 12x32 Pop-Up Bolometer Array for the SHARC II Camera**

Dowell, C. Darren, California Inst. of Tech., USA; Groseth, Jeffrey E., California Inst. of Tech., USA; Phillips, Thomas G., California Inst. of Tech., USA; Allen, Christine A., NASA Goddard Space Flight Center, USA; Babu, Sachidananda R., NASA Goddard Space Flight Center, USA; Jhabvala, Murzy D., NASA Goddard Space Flight Center, USA; Moseley, S. Harvey, Jr., NASA Goddard Space Flight Center, USA; Voellmer, George M., NASA Goddard Space Flight Center, USA; [2002]; 4p; In

English; FAR-IR, SUB-MM and MM Detector Workshop, Unknown, Unknown

Contract(s)/Grant(s): NSF AST-99-80846

Report No.(s): Rept-2002-4; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

SHARC II is a 350 micron facility camera for the Caltech Submillimeter Observatory (CSO) expected to come on-line in 2002. The key component of SHARC II is a 12x32 array of doped silicon 'pop-up' bolometers developed at NASA/Goddard and delivered to Caltech in March 2002. Each pixel is 1 mm x 1 mm, coated with a 400 Omega/square bismuth film, and located  $\lambda/4$  above a reflective backshort to maximize radiation absorption. The pixels cover the focal plane with greater than 95% filling factor. Each doped thermistor occupies nearly the full area of the pixel to minimize 1/f noise. We report some results from the first cold measurements of this array. The bolometers were located inside a dark cover, and 4x32 pixels were read simultaneously. In the best 25% of winter nights on Mauna Kea, SHARC II is expected to have an NEFD at 350 microns of 1 Jy s (sup 1/2) or better.

Author

*Bolometers; Arrays; Cameras; Astronomical Observatories*

**20030016723** California Inst. of Tech., Pasadena, CA USA

**SHARC II: A Caltech Submillimeter Observatory Facility Camera with 384 Pixels**

Dowell, C. Darren, California Inst. of Tech., USA; Allen, Christine A., NASA Goddard Space Flight Center, USA; Babu, Sachidananda, NASA Goddard Space Flight Center, USA; Freund, Minoru, NASA Goddard Space Flight Center, USA; Gardner, Matthew B., California Inst. of Tech., USA; Groseth, Jeffrey, California Inst. of Tech., USA; Jhabvala, Murzy, NASA Goddard Space Flight Center, USA; Kovacs, Attila, California Inst. of Tech., USA; Lis, Dariusz C., California Inst. of Tech., USA; Moseley, S. Harvey, Jr., NASA Goddard Space Flight Center, USA; [2002]; 14p; In English; Millimeter and Submillimeter Detectors for Astronomy, Unknown

Contract(s)/Grant(s): NSF AST-99-80846

Report No.(s): Rept-2002-5; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

SHARC II is a background-limited 350 micron and 450 micron facility camera for the Caltech Submillimeter Observatory undergoing commissioning in 2002. The key component of SHARC II is a 12 x 32 array of doped silicon 'pop-up' bolometers developed at NASA/Goddard. Each 1 mm x 1 mm pixel is coated with a 400 Omega/square bismuth film and located  $\lambda/4$  above a reflective backshort to achieve greater than 75% absorption efficiency. The pixels cover the focal plane with greater than 90% filling factor. At 350 microns, the SHARC II pixels are separated by 0.65  $\lambda/D$ . In contrast to the silicon bolometers in the predecessor of SHARC II, each doped thermistor occupies nearly the full area of the pixel, which lowers the 1/f knee of tile detector noise to less than 0.03 Hz, under load, at tile bath temperature of 0.36 K. The bolometers are AC-biased and read in 'total power' mode to take advantage of the improved stability. Each bolometer is biased through a custom approx. 130 M $\Omega$  CrSi load resistor at 7 K and read with a commercial JFET at 120 K. The JFETs and load resistors are integrated with the detectors into a single assembly to minimize microphonic noise. Electrical connection across the 0.36 K to 4 K and 4 K to 120 K temperature interfaces is accomplished with lithographed metal wires on dielectric substrates. In the best 25% of winter nights on Mauna Kea, SHARC II is expected to have an NEFD at 350 micron of 1 Jy Hz (sup -1/2) or better. The new camera should be at least 4 times faster at detecting known point sources and 30 times faster at mapping large areas compared to the prior instrument.

Author

*Astronomical Observatories; Cameras; Submillimeter Waves; Doped Crystals; Silicon; Bolometers; Arrays*

## 36

### LASERS AND MASERS

*Includes lasing theory, laser pumping techniques, maser amplifiers, laser materials, and the assessment of laser and maser outputs. For cases where the application of the laser or maser is emphasized see also the specific category where the application is treated. For related information see also 76 Solid-State Physics.*

**20030015400** NASA Langley Research Center, Hampton, VA USA

**High Energy Double-Pulsed Ho:Tm:YLF Laser Amplifier**

Yu, Jirong, NASA Langley Research Center, USA; Braud, Alain, Science Applications International Corp., USA; Petros, Mulugeta, Science and Technology Corp., USA; Singh, Upendra N., NASA Langley Research Center, USA; [2002]; 4p; In English; 21st International Laser Radar Conference, 8-12 Jul. 2002, Quebec, Canada

Contract(s)/Grant(s): RTOP 757-01-00-01; Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Distribution as joint owner in the copyright; Distribution as joint owner in the copyright

A high energy double-pulsed Ho:Tm:YLF 2-micrometer laser amplifier has been demonstrated. 600 mJ per pulse pair under Q-switch operation is achieved with the gain of 4.4. This solid-state laser source can be used as lidar transmitter for multiple lidar applications such as coherent wind and carbon dioxide measurements.

Author

*High Power Lasers; Light Amplifiers; Holmium; Thulium; Energy Distribution; YLF Lasers; Pulsed Lasers*

**20030015418** Air Force Research Lab., Air Vehicles Directorate, Wright-Patterson AFB, OH USA

**Random Vibration Tests for Prediction of Fatigue Life of Diffuser Structure for Gas Dynamic Laser Final Report, 1 Jan.-1 Dec. 1979**

Maurer, O. F.; Banaszak, D. L.; Jan. 1980; 56p; In English

Contract(s)/Grant(s): Proj-317J

Report No.(s): AD-A409466; AFWAL-TM-80-68-FBIG; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Static and dynamic strain measurements which were taken during test stand operations of the gas dynamic laser (GDL) for the AF Airborne Laser Laboratory indicated that higher than expected vibrational stress levels may possibly limit the fatigue life of the laser structure. Particularly the diffuser sidewall structure exhibited large amplitude random vibrations which were excited by the internal gas flow. The diffuser structure consists of two layers of brazed stainless steel, AISI-347, panels. Cooling ducts were milled into the outer face sheet. These in turn are backed by the inner face sheet. So called T-rail stiffeners silver-brazed to the outer face sheets add the required stiffness and divide the sidewall into smaller rectangular plate sections.

DTIC

*Random Vibration; Performance Tests; Fatigue Life; Gasdynamic Lasers; Vibrational Stress; Vibration Tests; Lasers*

**20030015422** Air Force Research Lab., Propulsion Directorate West, Edwards AFB, CA USA

**Laser-Powered, Vertical Flight Experiments at the High Energy Laser System Test Facility**

Mead, Franklin B., Jr.; Larson, C. W.; Nov. 13, 2000; 4p; In English; Pres. at AIAA/ASME/SAE/ASEE Joint Propulsion Conference (37th). Held in Salt Lake City, UT, 8-11 Jul 2001

Contract(s)/Grant(s): AF Proj. 1011

Report No.(s): AD-A409444; AFRL-PR-ED-AB-2000-218; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

In 1996, the Air Force Research Laboratory's Propulsion Division at Edwards AFB initiated a program that had as its main objective to launch a laser-propelled vehicle into a suborbital trajectory within a period of 5 years in order to demonstrate the concept and its attractive features. The concept is a nanosatellite in which the laser propulsion engine and satellite hardware are intimately shared. The Lightcraft Technology Demonstration Program was planned in three phases. Phase I, Lightcraft Concept Demonstration, was to demonstrate the feasibility of the basic concept. This phase ended in December 1998. Phase II, Lightcraft Vertical Launches to Extreme Altitudes, was initiated in January 1999, and is a five-year effort designed to extend Lightcraft flights in sounding rocket trajectories to 30 km with a 100 kW CO<sub>2</sub> laser. Phase III, Lightcraft Dual Mode Vehicle, is a two year effort designed to launch the first laser-propelled vehicle, fully functional, into space. This phase will require the construction of a megawatt class CO<sub>2</sub> laser with appropriate optics to meet the power beam propagation requirements.

DTIC

*Carbon Dioxide Lasers; Test Facilities; Pulsed Lasers; Vertical Flight; Hybrid Propulsion; Technology Utilization*

**20030015733** Computer Sciences Corp., Moffett Field, CA USA

**Microscopic Foundation and Simulation of Coupled Carrier-Temperature Diffusions in Semiconductor Lasers**

Li, J., NASA Ames Research Center, USA; Ning, Cun-Zheng, NASA Ames Research Center, USA; Oct. 09, 2002; 8p; In English; 2nd International Conference on Simulation of Optoelectronic Devices, USA, USA

Contract(s)/Grant(s): DTT559-99-D-00437; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

A typical semiconductor-based optoelectronic device, such as a diode laser, consists of three subsystems: an optical field, an electron-hole plasma (EHP), and a host crystal lattice. The physics of such a device involves the interplay of optical, electrical and thermal processes. A proper description of such a device requires that all three processes are treated on equal footing and in a self-consistent fashion. Furthermore, since a semiconductor laser has intrinsic spatial inhomogeneity, such a self-consistency naturally leads to a set of partial differential equations in space and time. There is a significant lacking of research interest and results on the transport aspects of optical devices in the literature with only a few exceptions. Even the most important carrier diffusion coefficient has not been properly derived and studied so far for optically excited plasma, while most of the work adopted results from electronics community where heavily doped semiconductors with mainly one type of carriers are dealt with. The corresponding transport equation for plasma energy or temperature has received even less attention. In this talk we describe our recent results on such a self-consistent derivation of temperature and carrier-density diffusion equations coupled with the lasing

process. Starting from the microscopic semiconductor Bloch equations (SBEs) including the Boltzmann transport terms in the distribution function equations for electrons and holes, we derived a closed set of diffusion equations for carrier densities and temperatures with self-consistent coupling to Maxwell's equation and to an effective optical polarization equation. The coherent many-body effects are included within the screened Hartree-Fock approximation, while scatterings are treated within the second Born approximation including both the in- and out-scatterings. Microscopic expressions for electron-hole (e-h) and carrier-LO (c-LO) phonon scatterings are directly used to derive the momentum and energy relaxation rates. These rates expressed as functions of temperatures and densities lead to microscopic expressions for self- and mutual-diffusion coefficients in the coupled density-temperature diffusion equations. Approximations for reducing the general two-component description of the electron-hole plasma (EHP) to a single-component one are discussed. In particular, we show that a special single-component reduction is possible when e-h scattering dominates over c-LO phonon scattering. The ambipolar diffusion approximation is also discussed and we show that the ambipolar diffusion coefficients are independent of e-h scattering, even though the diffusion coefficients of individual components depend sensitively on the e-h scattering rates. Our discussions lead to new perspectives into the roles played in the single-component reduction by the electron-hole correlation in momentum space induced by scatterings and the electron-hole correlation in real space via internal static electrical field. Finally, the theory is completed by coupling the diffusion equations to the lattice temperature equation and to the effective optical polarization which in turn couples to the laser field. The equations derived above are implemented in various limiting cases to a typical diode laser to study the consequences of nonlinear diffusion and the cross diffusion terms on laser behavior, especially the dynamic behavior of a diode laser under modulation. Detailed results will be presented by comparing with the standard rate equation results.

Author

*Semiconductor Lasers; Optoelectronic Devices; Diffusion; Plasmas (Physics); Boltzmann Transport Equation; Distribution Functions; Maxwell Equation; Optical Polarization*

**20030015753** NASA Langley Research Center, Hampton, VA USA

**Double-Pulsed 2-micron Laser Transmitter for Multiple Lidar Applications**

Singh, Upendra N., NASA Langley Research Center, USA; Yu, Jirong, NASA Langley Research Center, USA; [2002]; 3p; In English; 2nd Annual Earth Science Technology Conference, 11-13 Jun. 2002, Pasadena, CA, USA; Original contains color illustrations; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

A high energy double-pulsed Ho:Tm:YLF 2-micron laser amplifier has been demonstrated. 600 mJ per pulse pair under Q-switch operation is achieved with the gain of 4.4. This solid-state laser source can be used as lidar transmitter for multiple lidar applications such as coherent wind and carbon dioxide measurements.

Author

*Solid State Lasers; Q Switched Lasers; Optical Radar; Amplifiers; Transmitters*

**20030015812** Massachusetts Inst. of Tech., Center for Space Research, Cambridge, MA USA

**Research Participation in the Mars Orbiter Laser Altimeter Experiment *Interim Report, 15 Jan. 2002 - 14 Jan. 2003***

Pettengill, Gordon H., Massachusetts Inst. of Tech., USA; Jan. 31, 2003; 2p; In English; Original contains color illustrations  
Contract(s)/Grant(s): NAG5-11575

Report No.(s): OSP-6892974; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

This report describes the tasks that have been completed by the Principal Investigator, Gordon Pettengill, and his team during the first year of this grant. Dr. Pettengill was assisted by Dr. Peter Ford and Ms. Joan Quigley. Our main task has been to analyze the polar clouds detected by MOLA (Mars Orbiter Laser Altimeter) during the nominal mission of the Mars Global Surveyor (MGS) in 1999-2001 and to correlate the results with other data sets, in particular that from TES, the MGS thermal emission spectrometer. Starting with the Martian cloud database that we constructed prior to the start of this grant, we have examined all TES footprints that overlap MOLA clouds in time and space, correlating the thermal signature against specific categories that we assign to MOLA clouds on the basis of visual inspection. We are particularly interested in clouds in the region of "cold spots", areas of anomalously low thermal brightness temperature that have been detected in the polar winter by several instruments beginning with IRIS on Mariner 9. They are thought to indicate regions of active CO<sub>2</sub> sublimation or snowfall, and it is hoped that MOLA measurements may tell us more about these regions.

Derived from text

*Laser Altimeters; Mars Global Surveyor; Research and Development; Experimentation; Polar Meteorology; Ice Clouds*

**20030016556** Lawrence Livermore National Lab., Livermore, CA USA

**Fast Gate: Subnanosecond Gated Detectors for Laser Radiography**

Trebes, J.; Feit, M.; Hatchett, S.; Key, M.; Perry, M.; Feb. 25, 2000; 14p; In English

Report No.(s): DE2002-792444; UCRL-ID-137925; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

No abstract available.

NTIS

*Radiography; Hydrodynamics; Detection*

**37**

**MECHANICAL ENGINEERING**

*Includes mechanical devices and equipment; machine elements and processes. For cases where the application of a device or the host vehicle is emphasized see also the specific category where the application or vehicle is treated. For robotics see 63 Cybernetics, Artificial Intelligence, and Robotics; and 54 Man/System Technology and Life Support.*

**20030014820** White Sands Test Facility, Las Cruces, NM USA

**Composite Overwrapped Pressure Vessels: Database Extension Task 3.0 and Impact Damage Effects Control Task 8.0**

Beeson, Harold D., White Sands Test Facility, USA; Davis, Dennis D., Honeywell Technology Solutions, Inc., USA; Ross, William L., Sr., Honeywell Technology Solutions, Inc., USA; Tapphorn, Ralph M., Honeywell Technology Solutions, Inc., USA; January 2002; 270p; In English; Original contains color illustrations

Report No.(s): NASA/TP-2002-210769; NAS 1.60:210769; S-878; No Copyright; Avail: CASI; A12, Hardcopy; A03, Microfiche

This document represents efforts accomplished at the NASA Johnson Space Center White Sands Test Facility (WSTF) in support of the Enhanced Technology for Composite Overwrapped Pressure Vessels (COPV) Program, a joint research and technology effort among the U.S. Air Force, NASA, and the Aerospace Corporation. WSTF performed testing for several facets of the program. Testing that contributed to the Task 3.0 COPV database extension objective included baseline structural strength, failure mode and safe-life, impact damage tolerance, sustained load/impact effect, and materials compatibility. WSTF was also responsible for establishing impact protection and control requirements under Task 8.0 of the program. This included developing a methodology for establishing an impact control plan. Seven test reports detail the work done at WSTF. As such, this document contributes to the database of information regarding COPV behavior that will ensure performance benefits and safety are maintained throughout vessel service life.

Author

*Composite Wrapping; Data Bases; Impact Damage; Pressure Vessels; Structural Failure*

**20030015404** NASA Langley Research Center, Hampton, VA USA

**Variability Analysis in Vacuum Assisted Resin Transfer Molding**

Hubert, Pascal, Old Dominion Univ., USA; Pipes, R. Byron, Akron Univ., USA; Grimsley, Brian W., NASA Langley Research Center, USA; [2002]; 12p; In English; SAMPE Europe 23rd International Conference, 4-11 Apr. 2002, Port de Versailles, France; Sponsored by Society for the Advancement of Materials and Process Engineering, USA; Original contains color illustrations; Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche; Distribution as joint owner in the copyright; Distribution as joint owner in the copyright

The vacuum assisted resin transfer molding (VARTM) process is a low-cost, innovative method that is being considered for manufacture of large aircraft-quality components where high mechanical properties and dimensional tolerance are essential. In the present work a rigorous science-based approach is used to study the VARTM processing of high performance complex shape components. A process model, COMPRO, is used to simulate the cure of panels produced by VARTM. It was found that the presence of the distribution media significantly affects the magnitude of the exotherm particularly for thick panels. For C-shaped laminates, the part distortion was a function of fiber volume fraction distribution and was affected by the presence of the distribution media.

Author

*Resin Transfer Molding; Vacuum; Variability; Mechanical Properties; Manufacturing; Spacecraft Components*

**20030016715** Lawrence Livermore National Lab., Livermore, CA USA

**Isotopic Tracing of Particulate Matter from a Compression Ignition Engine Fueled with Ethanol-in-Diesel Blends**

Cheng, A. S.; Dibble, R. W.; Buchholz, B.; Nov. 22, 1999; 14p; In English

Report No.(s): DE2002-792748; UCRL-JC-136605; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Environmental and human health concerns over emissions from internal combustion engines continue to bring about increasingly stringent emissions standards and drive research into the use of non-conventional, cleaner-burning fuels. For compression-ignition (diesel) engines, oxygenated fuels have been shown to dramatically reduce particulate matter (PM) while also improving or maintaining acceptable levels of other regulated emissions (NO<sub>x</sub>, HC and CO). The mechanisms through which oxygenates reduce PM, however, are not fully understood. In addition to changes in combustion chemistry, the influence of thermophysical properties on fuel injection and fuel-air mixing can play a significant role. To gain further insight into the effect of oxygenates on diesel engine PM emissions, Accelerator Mass Spectrometry (AMS) was used to investigate the relative contribution to soot (the carbonaceous component of PM) from the ethanol and diesel fractions of blended fuels.

NTIS

*Ethyl Alcohol; Particulates; Isotopes; Diesel Fuels; Internal Combustion Engines; Combustion Chemistry*

**20030017993** Toledo Univ., Dept. of Mechanical, Industrial and Manufacturing Engineering, OH USA

**Development of Novel Methods for the Reduction of Noise and Weight in Helicopter Transmissions Final Report**

Dimofte, Florin, Toledo Univ., USA; Keith, Theo G., Jr., Toledo Univ., USA; [2003]; 21p; In English

Contract(s)/Grant(s): NAG3-2269; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Over the 70-year evolution of the helicopter, man's understanding of vibration control has greatly increased. However, in spite of the increased performance, the extent of helicopter vibration problems has not significantly diminished. Crew vibration and noise remains important factors in the design of all current helicopters. With more complex and critical demands being placed on aircrews, it is essential that vibration and noise not impair their performance. A major source of helicopter cabin noise (which has been measured at a sound pressure level of over 100 dB) is the gearbox. Reduction of this noise has been a goal of NASA and the U.S. Army. Gear mesh noise is typically in the frequency range of 1000 to 3000 Hz, a range important for speech. A requirement for U.S. Army/NASA Advanced Rotorcraft Transmission project has been a 10-dB reduction compared to current designs. A combined analytical/experimental effort has been underway, since the end of the 80's, to study effects of design parameters on noise production. The noise generated by the gear mesh can be transmitted to the surrounding media through the bearings that support the gear shaft. Therefore, the use of fluid film bearings instead of rolling element bearings could reduce the transmission noise by 10 dB. In addition, the fluid film bearings that support the gear shaft can change the dynamics of the gear assembly by providing damping to the system and by being softer than rolling element bearings. Wave bearings can attenuate, and filter, the noise generated by a machine component due to the dynamic stiffness and damping coefficients. The attenuation ratio could be as large as 35-40 dB. The noise components at higher frequencies than a synchronous frequency can be almost eliminated.

Derived from text

*Aircraft Noise; Noise Reduction; Rotary Wing Aircraft; Transmissions (Machine Elements); Helicopter Propeller Drive; Weight Reduction; Mechanical Engineering*

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### QUALITY ASSURANCE AND RELIABILITY

*Includes approaches to, and methods for reliability analysis and control, inspection, maintainability, and standardization.*

**20030015408** NASA Langley Research Center, Hampton, VA USA

**The Use of Doublers in Delamination Toughness Testing**

Reeder, James R., NASA Langley Research Center, USA; Demarco, Kevin, Swales Aerospace, USA; Whitley, Karen S., NASA Langley Research Center, USA; [2002]; 10p; In English; American Society for Composites 17th Technical Conference, 21-23 Oct. 2002, West Lafayette, IN, USA; Sponsored by American Society for Composites, USA; Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche; Distribution as joint owner in the copyright; Distribution as joint owner in the copyright

In this paper, the data reduction equations for common delamination toughness tests are rederived for use with specimens which have bonded doublers. The common toughness tests considered here are the double cantilever beam (DCB) for mode I toughness; the end notch flexure (3ENF) and 4 point ENF (4ENF) for mode II toughness; and the mixed mode bending (MMB) test for testing under combined mode I and mode II loading. Because the addition of the doublers changes the bending stiffness of the specimens, these data reduction equations may need to be corrected. Doublers were added to the delamination test specimens

to solve a premature failure problem. Delamination toughness is normally tested using a beam with an imbedded insert so that one end of the specimen is split into two arms. If the specimen is too thin, or if the toughness of the material is too high, an arm of the specimen may fail in bending before the delamination grows. When this occurs, the toughness of the material cannot be determined. To delay the bending failure so that delamination growth occurs, doubler plates were bonded to both top and bottom surfaces of the specimen. A doubler parameter, beta, which describes how much the use of doubler plates changed the ratio of full thickness to delaminated bending stiffnesses, was defined. When changes to the data reduction equations were required, the changes were minor when written in terms of the beta parameter. The doubler plate technique was demonstrated by measuring the mixed-mode fracture toughness of a carbon-carbon composite using test specimens which would otherwise have failed before delamination growth occurred. The doubler plate technique may solve several problems that can be encountered when testing delamination fracture toughness.

Author

*Destructive Tests; Impact Tests; Data Reduction; Fracture Strength; Toughness; Carbon-Carbon Composites; Delaminating; Fatigue (Materials)*

**20030015436** Air Force Research Lab., Materials and Manufacturing Directorate, Wright-Patterson AFB, OH USA

**Advanced Nondestructive Evaluation (NDE) Methods. Work Unit Directive (WUD) 40**

Oct. 2002; 9p; In English

Contract(s)/Grant(s): Proj-2418

Report No.(s): AD-A409416; AFRL-ML-WP-TP-2002-408; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

This bibliography consists of a compilation of publications from 1994-1999.

DTIC

*Nondestructive Tests; Bibliographies; Ultrasonics*

**20030015840** Nondestructive Testing Information Analysis Center, Austin, TX USA

**Overview of Mathematical Modeling in Nondestructive Evaluation (NDE)**

Aldrin, John C.; Sep. 2002; 41p; In English

Contract(s)/Grant(s): SPO700-97-D-4009

Report No.(s): AD-A409520; NTIAC-TA-02-01; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report presents a broad overview of mathematical modeling in nondestructive evaluation (NDE). The primary emphasis is to expand the review of NDE modeling literature covered by previous general works. To provide a starting point for researchers and engineers, the discussions and references include multiple modeling approaches (analytical, asymptotic, and numerical) for a variety of NDE techniques. A second emphasis for this report is to present the pertinent modeling software packages for a variety of NDE techniques. Overviews of modeling for four NDE techniques, ultrasonic testing, eddy current testing, radiography, and thermography are presented. In order to present the broad subject of NDE modeling for this report, the discussions of modeling research and software packages are limited in scope; however, numerous references are provided in each section for further study by the reader. Given the inherent depth and importance of the field, special emphasis is given to ultrasonic NDE. Discussions are presented on the generation of ultrasound, wave propagation in elastic solids, scattering from cracks, and waves in guides and at interfaces.

DTIC

*Mathematical Models; Nondestructive Tests; General Overviews; Applications Programs (Computers)*

**20030017756** National Inst. of Standards and Technology, Gaithersburg, MD USA

**Analysis of the ASTM Round-Robin Test on Particle Size Distribution of Portland Cement: Phase II**

Ferraris, C. F.; Hackley, V. A.; Aviles, A. I.; Buchanan, C. E.; Dec. 2002; 76p; In English; Prepared in cooperation with Roan Industries, Inc., Bakersville, NC

Report No.(s): PB2003-101574; NISTIR-6931; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

A distribution of sizes or particle size distribution (PSD) is an essential property of cement powder. The only standard method to measure the PSD of cement, namely ASTM C115 is limited in scope; this standard only describes a method for determining 'fineness' with a lower size detection limit of 7.5 micrometers. As there is no standard procedure covering the whole range of cement PSD, the implementation of different measurement methods varies widely within the industry. A first report was prepared to examine the methods used in the cement industry. The high variability of the data led to the necessity for further research. ASTM committee CO1.25.01 sponsored a second round-robin test to measure the PSD of cement. The aim of the current report is to analyze the data generated during that test and to summarize the various approaches available to measure the PSD of cement. The analysis of the data is conducted in two parts. In the first part, an attempt is made to establish a reference distribution using a

standard cement powder (SRM 114p), improving the results already obtained from the first round-robin. This is followed by examination of the parameters and methodology used by the participants in order to initiate discussion on developing a standard test method for cement PSD to be submitted for ASTM consideration. The report provides all raw data collected during the round-robin tests, and the results of a statistical analysis of the collected data.

NTIS

*Particle Size Distribution; Concretes; Statistical Analysis; Cements*

**20030017988** Huazhong Univ. of Science and Technology, School of Mechanical Engineering, Wuhan, China

**A Novel Application of Wavelet-Based Bispectrum Analysis to Diagnose Faults in Gears**

Liangcai, Xiong, Huazhong Univ. of Science and Technology, China; Tielin, Shi, Huazhong Univ. of Science and Technology, China; Shuzi, Yang, Huazhong Univ. of Science and Technology, China; Rao, Raj B. K. N., COMADEM International, UK; International Journal of COMADEM; July 2002; ISSN 1363-7681; Volume 5, No. 3, pp. 31-38; In English

Contract(s)/Grant(s): NNSFC-PD9521908; NNSFC-G1998020320; Copyright; Avail: Issuing Activity

Aimed at the non-stationary and non-Gaussian nature of the signals generated during the condition monitoring and diagnosis of the performance of gears, a novel proactive strategy for detecting the incipient faults developed in gears is put forward in this paper. This is accomplished in two ways. Firstly, the original signal is decomposed using wavelet transformation followed by the application of bispectrum analysis. This methodology not only integrates the merits of both the analytical techniques, but also it offers an efficient tool to extract the fault features of the gear under investigation. The findings obtained from the results of this investigation are promising.

Author

*Signal Processing; Wavelet Analysis; Systems Health Monitoring; Gears; Spectrum Analysis*

**20030017997** Huazhong Univ. of Science and Technology, Dept. of Mechanical Science and Electronic Information Engineering, Wuhan, China

**Application of Generative Topographic Mapping to Gear Failures Monitoring**

Liao, Guanglan, Huazhong Univ. of Science and Technology, China; Li, Weihua, Huazhong Univ. of Science and Technology, China; Shi, Tielin, Huazhong Univ. of Science and Technology, China; Rao, Raj B. K. N., COMADEM International, UK; International Journal of COMADEM; July 2002; ISSN 1363-7681; Volume 5, No. 3, pp. 14-20; In English

Contract(s)/Grant(s): NNSFC-G1998020320; Copyright; Avail: Issuing Activity

The Generative Topographic Mapping (GTM) model is introduced as a probabilistic re-formation of the self-organizing map and has already been used in a variety of applications. This paper presents a study of the GTM in industrial gear failures monitoring. Vibration signals are analyzed using the GTM model, and the results show that gear feature data sets can be projected into a two-dimensional space and clustered in different areas according to their conditions, which can classify and identify clearly a gear work condition with cracked or broken tooth compared with the normal condition. With the trace of the image points in the two-dimensional space, the variation of gear work conditions can be observed visually, therefore, the occurrence and varying trend of gear failures can be monitored in time.

Author

*Applications Programs (Computers); Mapping; Functions (Mathematics); Systems Health Monitoring; Failure Analysis; Gears; Artificial Intelligence*

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### STRUCTURAL MECHANICS

*Includes structural element design, analysis and testing; dynamic responses of structures; weight analysis; fatigue and other structural properties; and mechanical and thermal stresses in structure. For applications see 05 Aircraft Design, Testing and Performance and 18 Spacecraft Design, Testing and Performance.*

**20030014826** NASA Johnson Space Center, Houston, TX USA

**Predicting Fatigue for Isolated Joints While Wearing an Extra-Vehicular Mobility Unit (EMU)**

Maida, James C., NASA Johnson Space Center, USA; Gonzalez, L. Javier, Johnson Engineering Corp., USA; Rajulu, Sudhaker, National Space Biomedical Research Inst., USA; Miles, Erica, Lockheed Martin Corp., USA; [2001]; 4p; In English; SAE Digital Human Modeling Conference, 26-28 Jun. 2001, Arlington, VA, USA; Sponsored by Society of Automotive Engineers, Inc., USA

Contract(s)/Grant(s): 96-HEDS-05

Report No.(s): SAE-01DHM-11; Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Distribution as joint owner in the copyright; Distribution as joint owner in the copyright

To work outside a space craft, humans must wear a protective suit. The required suit pressurization creates additional resistance for the wearer while performing work. How much does the suit effect work and fatigue? to answer these questions, dynamic torque was collected for the shoulder, elbow and wrist for six subjects in an Extra-vehicular Mobility Unit (EMU). In order to quantify fatigue, the subjects were to exert maximum voluntary torque for five minutes or until their maximum fell below 50% of their initial maximum for three consecutive repetitions. Using the collected torque and time data, logarithmic based functions were derived to estimate torque decay to within an absolute error of 20%. These results will be used in the development of a generalized tool for prediction of maximum available torque over time for humans using the current EMU.

Author

*Fatigue (Biology); Space Suits; Joints (Anatomy); Extravehicular Mobility Units; Protective Clothing*

**20030014910** Lawrence Livermore National Lab., Livermore, CA USA

**Pressure Measurements in a PBX 9501 Acceptor When Impacted by a Steel Plate That Was Accelerated by a Thermally Cooked Off PBX 9501 Charge**

Forbes, J. W., Lawrence Livermore National Lab., USA; Garcia, F., Lawrence Livermore National Lab., USA; Utiew, P. A., Lawrence Livermore National Lab., USA; Vandersall, K. S., Lawrence Livermore National Lab., USA; Greenwood, D. W., Lawrence Livermore National Lab., USA; Tarver, C. M., Lawrence Livermore National Lab., USA; 20th JANNAF Propulsion Systems Hazards Subcommittee Meeting; April 2002; Volume 1, pp. 245-253; In English; Also announced as 20030014891

Contract(s)/Grant(s): W-7405-eng-48; No Copyright; Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC

Measuring the violence of a thermal explosion of a cased explosive is important for evaluating safety issues of explosive devices in fires. A sympathetic initiation scenario was studied here where a 9.0 cm diameter by 2.5 cm thick disc of PBX 9501 donor charge encased in a 304 stainless steel assembly was heated on top and bottom flat surfaces until it thermally exploded. The initial heating rate at the metal/explosive interface was 5 C per minute until it reaches 170 C; then this temperature is held for 35 minutes to allow temperature equilibration to within a few degrees throughout the explosive. The heating resumed at a rate of 1 C per minute until the PBX 9501 donor thermally exploded. A PBX 9501 acceptor charge with carbon resistor and manganin foil pressure gauges inserted at various depths was placed at a 10 cm standoff distance from the donor charge's top steel cover plate. Piezoelectric arrival time pins were placed in front of the acceptor surface to measure the velocity and shape of the impacting plate. The stainless steel cover plate of the donor charge had a nominal velocity of 0.55 +/- 0.04 mm/us upon impact and was non-symmetrically warped. The impact of the tilted curved plate induced a three-dimensional compression wave into the acceptor. The rise times of the pressure waves were nominally 1.5 microns with the closest carbon resistor gauges giving peak pressure of 10 kb that decayed to 3 kb for a wave run distance of 2.4 cm.

Author

*Pressure Measurement; Acceptor Materials; Metal Plates; Thermal Absorption*

**20030014943** Army Research Lab., Vehicle Technology Directorate, Hampton, VA USA

**Application of the Shell/3D Modeling Technique for the Analysis of Skin-Stiffener Debond Specimens**

Krueger, Ronald, NASA Langley Research Center, USA; O'Brien, T. Kevin, Army Research Lab., USA; Minguet, Pierre J., Boeing Co., USA; October 2002; 10p; In English; American Society for Composites 2002: 17th Annual Technical Conference, 21-23 Oct. 2002, West Lafayette, IN, USA; Sponsored by American Society for Composites, USA; Original contains color illustrations; ISBN 0-8493-1501-8; Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche; Distribution as joint owner in the copyright; Distribution as joint owner in the copyright

The application of a shell/3D modeling technique for the simulation of skin/stringer debond in a specimen subjected to three-point bending is demonstrated. The global structure was modeled with shell elements. A local three-dimensional model, extending to about three specimen thicknesses on either side of the delamination front was used to capture the details of the damaged section. Computed total strain energy release rates and mixed-mode ratios obtained from shell/3D simulations were in good agreement with results obtained from full solid models. The good correlations of the results demonstrated the effectiveness of the shell/3D modeling technique for the investigation of skin/stiffener separation due to delamination in the adherents.

Author

*Three Dimensional Models; Shells (Structural Forms); Debonding (Materials); Fracture Mechanics; Stringers*

**20030014946** NASA Langley Research Center, Hampton, VA USA

**Dot-Projection Photogrammetry and Videogrammetry of Gossamer Space Structures**

Pappa, Richard S., NASA Langley Research Center, USA; Black, Jonathan T., George Washington Univ., USA; Blandino, Joseph R., James Madison Univ., USA; Jones, Thomas W., NASA Langley Research Center, USA; Danehy, Paul M., NASA Langley Research Center, USA; Dorrington, Adrian A., National Academy of Sciences - National Research Council, USA; January 2003; 19p; In English; 21st International Modal Analysis Conference (IMAC), 3-6 Feb. 2003, Kissimmee, FL, USA; Original contains color illustrations

Contract(s)/Grant(s): RTOP 755-06-00-21

Report No.(s): NASA/TM-2003-212146; NAS 1.15:212146; E-18255; Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche; Distribution as joint owner in the copyright; Distribution as joint owner in the copyright

This paper documents the technique of using hundreds or thousands of projected dots of light as targets for photogrammetry and videogrammetry of gossamer space structures. Photogrammetry calculates the three-dimensional coordinates of each target on the structure, and videogrammetry tracks the coordinates versus time. Gossamer structures characteristically contain large areas of delicate, thin-film membranes. Examples include solar sails, large antennas, inflatable solar arrays, solar power concentrators and transmitters, sun shields, and planetary balloons and habitats. Using projected-dot targets avoids the unwanted mass, stiffness, and installation costs of traditional retroreflective adhesive targets. Four laboratory applications are covered that demonstrate the practical effectiveness of white-light dot projection for both static-shape and dynamic measurement of reflective and diffuse surfaces, respectively. Comparisons are made between dot-projection videogrammetry and traditional laser vibrometry for membrane vibration measurements. The paper closes by introducing a promising extension of existing techniques using a novel laser-induced fluorescence approach.

Author

*Photogrammetry; Video Equipment; Spacecraft Structures; Laser Induced Fluorescence*

**20030014949** NASA Glenn Research Center, Cleveland, OH USA

**CARES/LIFE Ceramics Analysis and Reliability Evaluation of Structures Life Prediction Program**

Nemeth, Noel N., NASA Glenn Research Center, USA; Powers, Lynn M., Case Western Reserve Univ., USA; Janosik, Lesley A., NASA Glenn Research Center, USA; Gyekenyesi, John P., NASA Glenn Research Center, USA; February 2003; 342p; In English

Contract(s)/Grant(s): RTOP 708-31-09

Report No.(s): NASA/TM-2003-106316; NAS 1.15:106316; E-13748; Copyright; Avail: CASI; A15, Hardcopy; A03, Microfiche; Distribution as joint owner in the copyright; Distribution as joint owner in the copyright

This manual describes the Ceramics Analysis and Reliability Evaluation of Structures Life Prediction (CARES/LIFE) computer program. The program calculates the time-dependent reliability of monolithic ceramic components subjected to thermomechanical and/or proof test loading. CARES/LIFE is an extension of the CARES (Ceramic Analysis and Reliability Evaluation of Structures) computer program. The program uses results from MSC/NASTRAN, ABAQUS, and ANSYS finite element analysis programs to evaluate component reliability due to inherent surface and/or volume type flaws. CARES/LIFE accounts for the phenomenon of subcritical crack growth (SCG) by utilizing the power law, Paris law, or Walker law. The two-parameter Weibull cumulative distribution function is used to characterize the variation in component strength. The effects of multiaxial stresses are modeled by using either the principle of independent action (PIA), the Weibull normal stress averaging method (NSA), or the Batdorf theory. Inert strength and fatigue parameters are estimated from rupture strength data of naturally flawed specimens loaded in static, dynamic, or cyclic fatigue. The probabilistic time-dependent theories used in CARES/LIFE, along with the input and output for CARES/LIFE, are described. Example problems to demonstrate various features of the program are also included.

Author

*Life (Durability); Fatigue (Materials); Reliability Analysis; Fractures (Materials); Structural Analysis; Finite Element Method; Ceramics*

**20030014978** NASA Langley Research Center, Hampton, VA USA

**Accelerated Threshold Fatigue Crack Growth Effect-Powder Metallurgy Aluminum Alloy**

Piasek, R. S., NASA Langley Research Center, USA; Newman, J. A., Army Research Lab., USA; [2002]; 8p; In English; Fatigue 2002: 8th International Fatigue Congress, 2-7 Jun. 2002, Stockholm, Sweden; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Fatigue crack growth (FCG) research conducted in the near threshold regime has identified a room temperature creep crack growth damage mechanism for a fine grain powder metallurgy (PM) aluminum alloy (8009). At very low ( $\Delta K$ ), an abrupt

acceleration in room temperature FCG rate occurs at high stress ratio ( $R = K(\text{sub min})/K(\text{sub max})$ ). The near threshold accelerated FCG rates are exacerbated by increased levels of  $K(\text{sub max})$  ( $K(\text{sub max}) = 0.4 K(\text{sub IC})$ ). Detailed fractographic analysis correlates accelerated FCG with the formation of crack-tip process zone micro-void damage. Experimental results show that the near threshold and  $K(\text{sub max})$  influenced accelerated crack growth is time and temperature dependent.

Author

*Aluminum Alloys; Crack Propagation; Metal Fatigue; Powder Metallurgy*

**20030015250** L'Garde, Inc., Tustin, CA USA

**A Comparison of the Performance of Seamed and Unseamed Inflatable Concentrators**

Pallsoc, Arthur; Thomas, Mitchell; Jan. 1995; 12p; In English

Report No.(s): AD-A409522; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Tests were run comparing seamed and unseamed inflatable concentrators. Measurements of the surface profiles showed that the effect of seams on surface accuracy was minimal. Surface errors were generally slowly varying across the membrane, exhibiting a "W" or "M" shape. When the membrane included seams, the result was a slight bumpiness in the error profile which retained the "W" or "M" shape at nearly the same level as without seams. Recent studies indicated that the major source of the surface error was more likely the variation material modulus as a function of position and stress. We used a special finite-element computer code to quantify the effect of seams; the results show again that the contribution of seams to the error in surface shape is negligible compared to the observed surface deviations in typical reflectors. The significance of these findings is that inflatable reflectors can be made inexpensively using seamed construction with no appreciable degradation of surface accuracy when compared to more expensive, continuous, formed membranes.

DTIC

*Inflatable Structures; Surface Properties; Shapes; Performance Tests; Seams (Joints)*

**20030015396** Textron Bell Helicopter, Fort Worth, TX USA

**Comparison of Hard Surface and Soft Soil Impact Performance of a Crashworthy Composite Fuselage Concept**

Sareen, Ashish K., Textron Bell Helicopter, USA; Sparks, Chad, Textron Bell Helicopter, USA; Mullins, B. R., Jr., Textron Bell Helicopter, USA; Fasanella, Edwin, Army Research Lab., USA; Jackson, Karen, Army Research Lab., USA; [2002]; 11p; In English; American Helicopter Society 58th Annual Forum, 11-13 Jun. 2002, Montreal, Canada; Sponsored by American Helicopter Society, Inc., USA; Original contains color illustrations

Contract(s)/Grant(s): NCC2-9019; Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche; Distribution as joint owner in the copyright under cooperative agreement NCC2-9019; Distribution as joint owner in the copyright under cooperative agreement NCC2-9019

A comparison of the soft soil and hard surface impact performance of a crashworthy composite fuselage concept has been performed. Specifically, comparisons of the peak acceleration values, pulse duration, and onset rate at specific locations on the fuselage were evaluated. In a prior research program, the composite fuselage section was impacted at 25 feet per second onto concrete at the Impact Dynamics Research Facility (IDRF) at NASA Langley Research Center. A soft soil test was conducted at the same impact velocity as a part of the NRTC/RITA Crashworthy and Energy Absorbing Structures project. In addition to comparisons of soft soil and hard surface test results, an MSC. Dytran dynamic finite element model was developed to evaluate the test analysis correlation. In addition, modeling parameters and techniques affecting test analysis correlation are discussed. Once correlated, the analytical methodology will be used in follow-on work to evaluate the specific energy absorption of various subfloor concepts for improved crash protection during hard surface and soft soil impacts.

Author

*Crashworthiness; Fuselages; Impact Velocity; Soils; Surface Geometry; Dynamic Models*

**20030015825** Sparta, Inc., Edwards AFB, CA USA

**Mode Mixity Determinations for Interfacial Cracking in Incompressible Materials Under Plane Strain Conditions**

Miller, Timothy C.; Apr. 22, 1998; 8p; In English

Contract(s)/Grant(s): AF Proj. 1011

Report No.(s): AD-A409481; AFRL-PR-ED-TP-1998-075; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

When a crack experiences plane strain conditions and lies along the interface between incompressible materials, the near tip field equations are simplified by the vanishing of the bimaterial parameter, epsilon. Finite element models that use a mixed

formulation can be used to characterize the complex stress intensity factor of these cracks completely. This is done by using J integral calculations and a regression of the ratio of bond line traction components to  $r = 0$ .

DTIC

*Plane Strain; Mathematical Models; Cracking (Fracturing); Mechanical Properties; Interfacial Tension; Incompressibility*

**20030015832** Air Force Research Lab., Space and Missile Propulsion Div., Edwards AFB, CA USA

**Overdeterministic Fracture Analysis and Singular Value Decomposition**

Miller, Timothy C.; Chona, Ravinder; Apr. 05, 1999; 6p; In English; Prepared in collaboration with Texas A & M Univ., College Station, TX

Contract(s)/Grant(s): AF Proj. 1011

Report No.(s): AD-A409496; AFRL-PR-ED-TP-1999-0073; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Using overdeterministic analysis to determine fracture parameters leads to unstable solutions in some cases because of ill-conditioning problems. The problem arises because some of the functions that constitute the overall field expressions are similar. In these cases the solution is best obtained using singular value decomposition, which solves for the coefficients effectively even when ill-conditioning is present, and quantifies the condition of the matrix. The method is explained and its use is demonstrated with two sets of results for interfacial cracks in thermally loaded bimetals.

DTIC

*Fracture Mechanics; Decomposition; Numerical Analysis; Matrices (Mathematics)*

**20030015835** Air Force Research Lab., Propulsion Directorate West, Edwards AFB, CA USA

**2302M1 Fracture Mechanics and Service Life Prediction Research**

Liu, C. T.; May 18, 1999; 20p; In English; Viewgraphs only. Presentation slides

Contract(s)/Grant(s): AF Proj. 1011

Report No.(s): AD-A409500; AFRL-PR-ED-TP-FY99-0092; No Copyright; Avail: Defense Technical Information Center (DTIC)

The presentation slides for the 2302M1 Fracture Mechanics and Service Life Prediction Research are presented.

DTIC

*Fracture Mechanics; Service Life; Crack Propagation; Rocket Engines; Research and Development*

**20030015836** Sparta, Inc., Edwards AFB, CA USA

**Adhesive Layer Effects on Interfacial Crack Tip Asymptotic Fields**

Miller, Timothy C.; May 12, 1998; 4p; In English

Contract(s)/Grant(s): AF Proj. 1011

Report No.(s): AD-A409501; AFRL-PR-ED-TP-1998-084; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The current work examines the effects of the adhesive layer by systematically varying the modulus in a thin layer of adhesive (0.40 mm) and studying the effects on the field variables near the crack tip. The adhesive layers have moduli that vary from 0.7 to 41.4 MPa, so that a range of situations is considered from adhesives that are relatively weak to those that are comparable to the other two materials.

DTIC

*Adhesives; Crack Tips; Asymptotic Properties; Surface Layers; Interfacial Tension*

**20030015851** Technische Hogeschool, Delft, Netherlands

**Numerical Investigation of the Meso-Mechanical Behavior of Concrete Under Impact Tensile Loading *Final Report, 20 Nov. 2000-20 May 2001***

Liu, W. Y.; Sluys, Lambertus J.; Oct. 2002; 52p; In English

Contract(s)/Grant(s): F61775-01-W-E002

Report No.(s): AD-A409539; EOARD-SPC-01-4002; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This report results from a contract tasking Delft University of Technology as follows: The contractor will investigate the mechanical behavior of brittle heterogeneous materials such as concrete extreme dynamic loading conditions. The contractor will develop a mathematical model of brittle heterogeneous materials under extreme dynamic loading conditions to accurately predict civil engineering structural responses not well predicted by existing quasi-static models.

DTIC

*Concretes; Mathematical Models; Mechanical Properties; Tensile Strength; Dynamic Loads; Impact Tests*

**20030016565** Instituto Nacional de Pesquisas Espaciais, Sao Jose dos Campos, Brazil

**Optimization of a Sandwich Panels by Using the Simulated Annealing Method** *Otimizacao de Paineis Sanduiche Utilizando o Metodo de Recozimento Simulado*

Bustamante, Renato Correa Ribeiro, Instituto Nacional de Pesquisas Espaciais, Brazil; 2002; 108p; In Portuguese Report No.(s): INPE-9255-TDI/817; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

The mass reduction of space structures is of great importance, since it allows the payload and/or space vehicles lifetime increase. As a consequence, the use of sandwich panels has been growing in the last years, since these panels have a high stiffness/weight ratio. The problem presented in this work is about mass minimization of sandwich panels facesheets. The panel facesheets are composed of a net of composite material fiber strips. Defining a nonuniform material distribution, taking into account a lower boundary for the first natural frequency as constraint reduces the mass of these facesheets. This problem was previously solved by using deterministic methods of optimization. However, as the structural optimization problems have many local minima, the deterministic methods present difficulty to find the global optimum design. To outline this problem, a stochastic algorithm has been used in this work, based on the Simulated Annealing method (SA), which allows directional and random search and it is able to reach the global minimum. The goal of this work is to study the behavior of the SA algorithm when it's used to solve structural optimization problems. The designs are generated randomly and the change costs (variation of the objective function) is evaluated. The outputs obtained with this method are compared with results from some deterministic optimization methods.

Author

*Optimization; Sandwich Structures; Simulated Annealing; Weight Reduction; Panels*

**20030016685** NASA Glenn Research Center, Cleveland, OH USA

**A Study of Time-Dependent and Anisotropic Effects on the Deformation Response of Two Flywheel Designs**

Saleeb, Atef F., Akron Univ., USA; Arnold, Steven M., NASA Glenn Research Center, USA; Al-Zoubi, Nasser R., Akron Univ., USA; January 2003; 32p; In English; 14th Symposium on Composite Materials: Testing and Design, 11-12 Mar. 2002, Pittsburgh, PA, USA; Sponsored by American Society for Testing and Materials, USA; Original contains color illustrations Contract(s)/Grant(s): RTOP 755-12-11

Report No.(s): NASA/TM-2003-212091; NAS 1.15:212091; E-13743; Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche; Distribution as joint owner in the copyright; Distribution as joint owner in the copyright

The influence of material time dependency and anisotropy in the context of two specific flywheel designs-preload and multi-directional composite (MDC)--is investigated. In particular, we focus on the following aspects: 1) geometric constraints, 2) material constraints, 3) loading type, and 4) the fundamental character of the time-dependent response, i.e., reversible or irreversible. The bulk of the results presented were obtained using a composite (PMC IM7/8552 at 135 C) material system. The material was characterized using a general multimechanism hereditary (viscoelastoplastic) model. As a general conclusion, the results have clearly shown that both the preload and the MDC rotor designs are significantly affected by time-dependent material behavior, which may impact the state of rotor balance and potentially reduce its operating life. In view of the results of the parametric studies and predictions made in the present study, the need for actual experimentation focusing on the time-dependent behavior of full-scale flywheel rotors is self-evident.

Author

*Time Dependence; Flywheels; Polymer Matrix Composites; Elastic Deformation; Viscoplasticity; Viscoelasticity*

**20030017747** NASA Langley Research Center, Hampton, VA USA

**Further Examination of the Vibratory Loads Reduction Results from the NASA/ARMY/MIT Active Twist Rotor Test**

Wilbur, Matthew L., NASA Langley Research Center, USA; Yeager, William T., Jr., NASA Langley Research Center, USA; Sekula, Martin K., NASA Langley Research Center, USA; 2002; 15p; In English; 58th American Helicopter Society Annual Forum, 11-13 Jun. 2002, Montreal, Canada; Sponsored by American Helicopter Society, Inc., USA; Original contains color illustrations; Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche; Distribution under U.S. Government purpose rights; Distribution under U.S. Government purpose rights

The vibration reduction capabilities of a model rotor system utilizing controlled, strain-induced blade twisting are examined. The model rotor blades, which utilize piezoelectric active fiber composite actuators, were tested in the NASA Langley Transonic Dynamics Tunnel using open-loop control to determine the effect of active-twist on rotor vibratory loads. The results of this testing have been encouraging, and have demonstrated that active-twist rotor designs offer the potential for significant load reductions in future helicopter rotor systems. Active twist control was found to use less than 1% of the power necessary to operate the rotor system and had a pronounced effect on both rotating- and fixed-system loads, offering reductions in individual harmonic loads of up to 100%. A review of the vibration reduction results obtained is presented, which includes a limited set of comparisons with

results generated using the second-generation version of the Comprehensive Analytical Model of Rotorcraft Aerodynamics and Dynamics (CAMRAD II) rotorcraft comprehensive analysis.

Author

*Rotor Aerodynamics; Vibratory Loads; Rotary Wing Aircraft; Vibration Damping; Active Control; Wind Tunnel Tests*

**20030017829** NASA Langley Research Center, Hampton, VA USA

**Videogrammetry Using Projected Circular Targets: Proof-of-Concept Test**

Pappa, Richard S., NASA Langley Research Center, USA; Black, Jonathan T., George Washington Univ., USA; February 2003; 14p; In English; 21st International Modal Analysis Conference (IMAC), 3-6 Feb. 2003, Kissimmee, FL, USA; Original contains color illustrations

Contract(s)/Grant(s): RTOP 755-06-00-21

Report No.(s): NASA/TM-2003-212148; NAS 1.15:212148; L-18257; Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche; Distribution as joint owner in the copyright; Distribution as joint owner in the copyright

Videogrammetry is the science of calculating 3D object coordinates as a function of time from image sequences. It expands the method of photogrammetry to multiple time steps enabling the object to be characterized dynamically. Photogrammetry achieves the greatest accuracy with high contrast, solid-colored, circular targets. The high contrast is most often effected using retro-reflective targets attached to the measurement article. Knowledge of the location of each target allows those points to be tracked in a sequence of images, thus yielding dynamic characterization of the overall object. For ultra-lightweight and inflatable gossamer structures (e.g. solar sails, inflatable antennae, sun shields, etc.) where it may be desirable to avoid physically attaching retro-targets, a high-density grid of projected circular targets - called dot projection - is a viable alternative. Over time the object changes shape or position independently of the dots. Dynamic behavior, such as deployment or vibration, can be characterized by tracking the overall 3D shape of the object instead of tracking specific object points. To develop this method, an oscillating rigid object was measured using both retroreflective targets and dot projection. This paper details these tests, compares the results, and discusses the overall accuracy of dot projection videogrammetry.

Author

*Photogrammetry; Three Dimensional Models; Inflatable Structures; Contours; Targets; Plates (Structural Members); Retroreflection*

**20030018096** National Academy of Sciences - National Research Council, Eglin AFB, FL USA

**Optimal Inflatable Space Towers of High Height**

Bolonkin, Alexander, National Academy of Sciences - National Research Council, USA; [2002]; 6p; In English; 34th COSPAR Scientific Assembly, 10-19 Oct. 2002, Houston, TX, Houston, TX, USA, USA; Sponsored by Committee on Space Research, Unknown

Report No.(s): COSPAR-02-C1.1-0035-02; Copyright; Avail: Issuing Activity

Author provides theory and computations for building inflatable space towers up to a hundred km in height. These towers can be used for tourism; scientific observation of space, earth's surface, weather, top atmosphere, as well as for radio, television, and communication transmissions. These towers can also be used to launch space ships and Earth satellites. These projects are not expensive and do not require rockets. They require thin strong films composed from artificial fibers and fabricated by current industry. Towers can be built using present technology. Towers can be used (for tourism, communication, etc.) during the construction process and provide self-financing for further construction. The tower design does not require work at high altitudes; all construction can be done at the earth's surface. The transport system for this tower consists a small engine (used only for friction compensation) located at the earth's surface. The tower is separated into sections and has special protection mechanism in case of a damage. Problems involving security, control, repair, and stability of the proposed towers are addressed in subsequent publications. The author is prepared to discuss these and other problems with serious organizations desiring to research and develop these projects.

Author

*Inflatable Structures; Towers; Construction Materials*

**20030018258** Osaka City Univ., Dept. of Urban Engineering, Japan

**A Simple Numerical Method for Biaxial Bending Moment-Curvature Relations of Reinforced Concrete Column Sections**

Sato, Tomoaki, Osaka City Univ., Japan; Shimada, Isao, Toyo-Giken Consultants Co. Ltd., Japan; Kobayashi, Harutoshi, Osaka City Univ., Japan; Memoirs of the Faculty of Engineering, Osaka City University; December 2002; ISSN 0078-6659; Volume 43, pp. 59-67; In English; Copyright; Avail: Issuing Activity

Proposed in this paper is a simple numerical method for computing the bending moment curvature relations for reinforced concrete rectangular cross section of bridge piers under biaxial bending action, which is essentially required at their seismic design considering a horizontal force due to earthquake in arbitrary direction. The cross section is divided by a number of rectangular finite areas of concrete and reinforcing bar areas. and then numerical integration technique is developed to evaluate the stress-strain relation for each rectangular finite area divided. Numerical results are presented to show validity of the present method with satisfactory accuracy compared with those by the method recommended in the Japanese seismic design code.

Author

*Numerical Integration; Concretes; Bending Moments; Composite Materials; Stress-Strain Relationships*

**20030018415** Toyo-Giken Consultants Co. Ltd., Osaka, Japan

**A Study on Accuracy of FEM Analysis for Plates Under Distributed Load**

Yamawaki, Manabu, Toyo-Giken Consultants Co. Ltd., Japan; Shimada, Isao, Toyo-Giken Consultants Co. Ltd., Japan; Kobayashi, Harutoshi, Osaka City Univ., Japan; Memoirs of the Faculty of Engineering, Osaka City University; December 2002; ISSN 0078-6659; Volume 43, pp. 69-78; In English; Copyright; Avail: Issuing Activity

As usual, the analysis of plates has been conventionally examined by the main series solution method. However, it is the present condition which is analyzed in many cases by FEM for reasons of how to search for the results, which can take into consideration the trust for accuracy, the required capacity in the computer and calculation time. Now, in the case of analyzing the bridge deck slab which receives moving load like traffic load, even if it changes meshing division one by one corresponding to a load position, the prior examination about accuracy of analysis will be needed. This report examines for using the various forms, the meshing divisions, and accuracy of the element applied about the problems. As a result, in bending moment, when the loading side divided into more than four parts, the comparatively good accuracy is obtained for any element. On the other hand, for shearing force, the comparatively good accuracy is obtained for using the higher order element.

Author

*Finite Element Method; Loads (Forces); Bending Moments; Slabs*

**42**

**GEOSCIENCES (GENERAL)**

*Includes general research topics related to the Earth sciences, and the specific areas of petrology, mineralogy, and general geology. For other specific topics in geosciences see categories 41 through 48.*

**20030014757** Humboldt State Univ., Arcata, CA USA

**USDA Forest Service Watershed Analyses: A Lesson in Interdisciplinary Natural Resource Management**

DeFalco, A. S.; May 1999; 96p; In English

Report No.(s): PB2003-102462; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

Recent thinking in natural resource management has led federal land management agencies such as the U.S. Department of Agriculture's Forest Service (Forest Service) to adopt ecosystem management as its official land management policy. A pivotal aspect of ecosystem management is interdisciplinary analysis of complex land management problems. Interdisciplinary watershed analysis attempts to engage in this approach and is intended to synthesize biological, physical, and socio-economic data in 20- to 200- square-mile watersheds in the Pacific Northwest. Watershed analysis is carried out by teams of natural resource specialists from different disciplines. However, interdisciplinary analysis by watershed analysis teams faces significant barriers to successful completion. One of these is a lack of research on how such analysis can become more interdisciplinary. Little research exists about interdisciplinary analysis by watershed analysis teams. Studies about benefits that the specialists and the agencies who conduct watershed analysis may gain are lacking as well. This study identified and analyzed enabling factors, disabling factors and benefits of interdisciplinary watershed analysis carried out by Forest Service teams.

NTIS

*Ecosystems; Forest Management; Land Management; Watersheds*

**20030014824** Forest Service, Washington, DC USA

**Statistical Package for Improved Analysis of Hillslope Monitoring Data Collected as Part of the Board of Forestry's Long-Term Monitoring Program Final Report**

Lewis, J.; Baldwin, J.; May 1997; 82p

Report No.(s): PB2003-102471; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

The State of California has embarked upon a Long-Term Monitoring Program whose primary goal is to assess the effectiveness of the Forest Practice Rules and Review Process in protecting the beneficial uses of waters from the impacts of timber operations on private timberlands. The Board of Forestry's Monitoring Study Group concluded that hillslope monitoring should be used to assess Rule implementation and effectiveness at preventing erosion and maintaining canopy cover, while instream monitoring would be used to assess conditions and trends in water quality and stream channels. The objectives and tasks of this report (distilled from the Study Plan) are to: (1) Evaluate and propose various statistical techniques, including nonparametric statistics, that can be used to analyze the kind of data collected on the 17 Timber Harvest Plans (THPs) during the Pilot Monitoring Program. (2) Provide guidelines for determining necessary sample sizes to achieve a specified degree of certainty in hypothesis testing and estimation. (3) Evaluate the sampling design and provide advice on how it might be improved. Assess the scope of the inferences that can be made. (4) Discuss the statistical compromises that may be necessary and recommend ways to address identified weaknesses.

NTIS

*Forest Management; Trends; Environmental Monitoring; Water Pollution; Logging (Industry)*

**20030016649** Durham Univ., Dept. of Geography, UK

**Stereo Applications of Corona, and the use of Ikonos for Ground Control: Case Study from Orontes Valley, Syria**

Galiatsatos, Nikolaos, Durham Univ., UK; International Conference on Remote Sensing Applications for Archeological Research and World Heritage Conservation; [2002], pp. 58; In English; Also announced as 20030016612; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

CORONA was a program for the support of U.S. Intelligence, which took place between 1958-1972. It officially started with the formal endorsement of President Dwight E. Eisenhower on 8th of February 1958. The launch operations began on 25th of June 1959. The first CORONA image of an intelligence target was acquired during Mission 9009 on 18th of August 1960. The camera carried on that Mission would be retroactively designated the KH-1 (KH for KeyHole). The next successful CORONA Mission would be conducted on 7th of December 1960. This time a more advanced camera system, the KH-2, would be on board. From that time, through to the end of Corona program on 4th of June 1972, there would be a succession of new camera systems -the KH-3, KH-4, KH-4A and KH-4B. The best ground resolution was 6ft (1.8m). Finally, CORONA would acquire over 800,000 frames of photographs. On 22<sup>nd</sup> of February 1995, President Clinton signed an executive order that declassified those images. The public access to the imagery began on 1st of March 1996.

Derived from text

*Imagery; Targets; Computer Programs*

**20030016721** Salmon River Restoration Council, Etna, CA USA

**Salmon River Shaded Fuel Break Construction and Riparian Fuels Reduction *Final Report***

Villeponteaux, J.; Greenberg, K.; Jul. 23, 2002; 13p

Report No.(s): PB2003-101710; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This project has enlisted private property owners from the community to steward their lands over time in a fashion that is consistent with ecosystem management over the larger landscape. The Salmon River Restoration Council (Council) has provided a crew of displaced timber worker from the community to construct fuel break systems, restore damaged riparian and wetlands habitat, reduce road caused erosion problems, and perform project inventory and monitoring tasks on several parcels of private property in the Salmon River sub-basin. Restoration activities have taken place on approximately 71 acres.

NTIS

*Fire Prevention; Ecosystems; River Basins; Fuel Systems; Erosion*

**20030017754** Montana State Univ., Dept. of Civil Engineering, Bozeman, MT USA

**Evaluation of Geosynthetic Reinforced Flexible Pavement Systems Using Two Pavement Test Facilities *Final Report, 17 Aug. 1999 - 30 Nov. 02***

Perkins, S. W.; Nov. 2002; 146p; In English

Report No.(s): PB2003-102213; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

The project was initiated to provide additional test section data to better define the influence of traffic loading type and geosynthetic reinforcement type. The loading provided to the test sections forming the basis of the models described above consisted of a cyclic load applied to a stationary plate. In this project, four full-scale test sections were constructed and loaded with a heavy vehicle simulator (HVS) located at the US Army Corp of Engineers facility in Hanover, NH. The four test sections used three geosynthetics identical to those used in previous test sections and pavement layer materials and thickness similar to previous sections. Additional test sections were constructed in the pavement test box used in previous studies to examine the

influence of base aggregate type, base course thickness reduction level sand reinforcement type. A rounded pit run aggregate was used in test sections to evaluate the influence of geosynthetic-aggregate shear interaction parameters on reinforcement benefit. The 1993 AASHTO Design Guide was used to back-calculate the base course thickness reduction from previous test section results where a traffic benefit ratio (extension of life) was known. Sections were built to this base course thickness reduction to see if equivalent life to an unreinforced section was obtained. Finally, six different geosynthetic products were used in test sections to evaluate the influence of reinforcement type on pavement performance.

NTIS

*Evaluation; Pavements; Flexibility; Reinforcement (Structures)*

**20030017758** Environmental Protection Agency, National Center for Environmental Assessment, Washington, DC USA  
**Clinch and Powell Rivers Watershed Ecological Risk Assessment**

Sep. 2002; In English; Available on CD-ROM and in paper copy only

Report No.(s): PB2003-101118; EPA/600/R-01/050; No Copyright; Avail: National Technical Information Service (NTIS)

A watershed ecological risk assessment of the unique Clinch and Powell river system in southwestern Virginia strongly suggests that (1) coal mining activities and agricultural practices, past and present, are having adverse impacts on stream habitats, resulting in unacceptable losses of valuable and rare native fish and mussels and (2) prompt implementation of practical risk-lowering actions, such as reclaiming abandoned mines, spill prevention, excluding livestock from streams, and establishing riparian vegetation zones, can mitigate these adverse effects in the future. The free-flowing Clinch and Powell Valley watershed, which drains into Norris Lake in northeastern Tennessee, has historically had one of the richest assemblages of native fish and freshwater mussels in the world. Nearly half of the species historically present are now extinct, threatened, or endangered. The U.S. Environmental Protection Agency's ecological risk assessment framework was used to structure a watershed-scale analysis of associations between land use and in-stream habitat and their effects on fish and mussels. Percent pasture area, percent crop land, and proximity to active mining, urban areas, or major transportation routes accounted for more than half of the variance in fish IBI scores, with coal mining having the most impact. Native fish and mussel populations appeared to be at greatest risk as more stressors co-occurred. Our results indicate that a number of sources and stressors are responsible for the decline in native species in the Clinch and Powell Valley watershed, but naturally vegetated riparian corridors may help mitigate some of these effects.

NTIS

*Watersheds; River Basins; Ecology; Risk; Environment Protection; Farm Crops; Prevention*

## 43

### EARTH RESOURCES AND REMOTE SENSING

*Includes remote sensing of earth features, phenomena and resources by aircraft, balloon, rocket, and spacecraft; analysis or remote sensing data and imagery; development of remote sensing products; photogrammetry; and aerial photographs. For instrumentation see 35 Instrumentation and Photography.*

**20030014735** NASA Langley Research Center, Hampton, VA USA

**Simulation and Correction of Triana-Viewed Earth Radiation Budget with ERBE/ISCCP Data**

Huang, Jian-Ping, AS and M, Inc., USA; Minnis, Patrick, NASA Langley Research Center, USA; Doelling, David R., AS and M, Inc., USA; Valero, Francisco P. J., Scripps Institution of Oceanography, USA; [2002]; 5p; In English; IGARSS 2002: International Geoscience and Remote Sensing Symposium, 24-28 Jun. 2002, Toronto, Canada; Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Distribution as joint owner in the copyright; Distribution as joint owner in the copyright

This paper describes the simulation of the earth radiation budget (ERB) as viewed by Triana and the development of correction models for converting Triana-viewed radiances into a complete ERB. A full range of Triana views and global radiation fields are simulated using a combination of datasets from ERBE (Earth Radiation Budget Experiment) and ISCCP (International Satellite Cloud Climatology Project) and analyzed with a set of empirical correction factors specific to the Triana views. The results show that the accuracy of global correction factors to estimate ERB from Triana radiances is a function of the Triana position relative to the Lagrange-1 (L1) or the Sun location. Spectral analysis of the global correction factor indicates that both shortwave (SW; 0.2 - 5.0 microns) and longwave (LW; 5 -50 microns) parameters undergo seasonal and diurnal cycles that dominate the periodic fluctuations. The diurnal cycle, especially its amplitude, is also strongly dependent on the seasonal cycle. Based on these results, models are developed to correct the radiances for unviewed areas and anisotropic emission and reflection.

A preliminary assessment indicates that these correction models can be applied to Triana radiances to produce the most accurate global ERB to date.

Author

*Earth Radiation Budget; Radiation Distribution; Satellite Observation; Earth Radiation Budget Experiment*

**20030015251** Naval Research Lab., Bay Saint Louis, MS USA

**Digital Mapping, Charting, and Geodesy Analysis Program (DMAP). Technical Review of Vector Data Update (VDU) Layer**

Mesick, Hillary C.; Carter, Susan V.; Breckenridge, John L.; Wilson, Ruth A.; Shaw, Kevin B.; Dec. 10, 2002; 8p; In English  
Contract(s)/Grant(s): A

Report No.(s): AD-A409521; NRL/MR/7440--02-8291; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The Vector Data Update (VDU) is a standard digital Geospatial Information and Services (GI&S) product used by the National Imagery and Mapping Agency (NIMA) to transmit Digital Nautical Chart (DNC) data updates to Naval Operational Forces, including Navy ships at sea. This review, conducted by the Naval Digital Mapping, Charting, and Geodesy (MC&G) Analysis Program (DMAP) at Stennis Space Center, MS, examines the Draft Performance Specification for VDU Layer, dated 3 October 2002.

DTIC

*Computer Aided Mapping; Geodesy; Digital Data; Information Systems*

**20030015484** Raytheon Information Technology and Scientific Services, Greenbelt, MD USA

**Reflectance-Based Sensor Validation Over Ice Surfaces Final Report, 29 Jul. 1998 - 15 Nov. 2002**

Jaross, Glen, Raytheon Information Technology and Scientific Services, USA; Jan. 17, 2003; 6p; In English

Contract(s)/Grant(s): NASW-98016; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

During this period work was performed in the following areas. These areas are defined in the Work Schedule presented in the original proposal: BRDF development, Data acquisition and processing, THR Table generation and Presentations and Publications. BRDF development involves creating and/or modifying a reflectance model of the Antarctic surface. This model must, for a temporal and spatial average, be representative of the East Antarctic plateau and be expressed in terms of the three standard surface angles: solar zenith angle (SolZA), view zenith angle (SatZA), and relative azimuth angle (RelAZ). We successfully acquired a limited amount of NOAA-9 AVHRR data for radiance validation. The data were obtained from the Laboratory for Terrestrial Physics at Goddard Space Flight Center. We developed our own reading and unpacking software, which we used to select Channel 1 data (visible). We then applied geographic subsetting criteria (same as used for TOMS), and wrote only the relevant data to packed binary files. We proceeded with analysis of these data, which is not yet complete.

Author

*Atmospheric Models; Spectral Reflectance; Data Acquisition; Data Processing; Applications Programs (Computers); Computerized Simulation*

**20030016510** Instituto Nacional de Pesquisas Espaciais, Sao Jose dos Campos, Brazil

**Reduction of Smoke Effects on NDVI Determination Minimizacao dos Efeitos da Fumaca Sobre o Calculo do NDVI**

LimadeMoura, Marcelo, Instituto Nacional de Pesquisas Espaciais, Brazil; 2002; 128p; In Portuguese; Original contains color illustrations

Report No.(s): INPE-8976-TDI/810; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

The objective of this dissertation is to discuss the effects of the smoke and the use of empirical relationships between the red (R) and mid-infrared (Mid-IR) for reduction of such effects on the vegetation index (VI) determination. For this purpose, a short temporal set of images from the Airborne Visible/Infrared Spectroradiometer (AVIRIS) acquired in three distinct dates (25/08/95, 27/08/95 and 01/09/95), over an area of study located near the city of Cuiabci (MT), was analyzed. to detect the changes occurred in the area during the data acquisition period, specialty those caused by the fire/smoke, a spectral mixture model was applied over the data. The effects of the smoke on the AVIRIS scene components were analyzed based on the results obtained by the spectral mixture model. Representative reflectance spectra of soil and savanna vegetation types were extracted from the image of August 25, 1995, in portions of the scene free of smoke to identify the Mid-IR band that better estimated the R band. The results showed that: a) the non photosynthetic vegetation (NPV) fraction image was the best product to enhance changes caused by fires in the period of study; b) the smoke effects are stronger in the visible region, decrease abruptly in the near-IR, and are practically negligible in the mid-IR. The magnitude of these effects is target dependent, although the causes of this dependence need to be better evaluated; c) the R reflectance, sensible to the smoke effects, can be estimated from the reflectance of the mid-IR band positioned at 2100 nm, which is not affected by the smoke effects; d) using this estimate, the atmospheric correction of the smoke

effects on the normalized difference vegetation index (NDVI) is adequate for the vegetation surfaces. For targets in which the relationship of the positive covariance between the R and Mid-IR bands is not observed, such as water and burned areas, discrepant results can be obtained from the NIDVI after correction of the smoke effects.

Author

*Smoke; Normalized Difference Vegetation Index; Infrared Radiation; Reflectance; Atmospheric Correction*

**20030016612** International Space Univ., Inc., Washington, DC USA

**International Conference on Remote Sensing Applications for Archaeological Research and World Heritage Conservation**

International Conference on Remote Sensing Applications for Archeological Research and World Heritage Conservation; [2002]; 59p; In English; Space Applications for Heritage Conservation, 5-8 Nov. 2002, Strasbourg, France; Sponsored by International Space Univ., Inc., USA; Also announced as 20030016613 through 20030016662

Contract(s)/Grant(s): NAG5-12308; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Contents include the following: Monitoring the Ancient Countryside: Remote Sensing and GIS at the Chora of Chersonesos (Crimea, Ukraine). Integration of Remote Sensing and GIS for Management Decision Support in the Pendjari Biosphere Reserve (Republic of Benin). Monitoring of deforestation invasion in natural reserves of northern Madagascar based on space imagery. Cartography of Kahuzi-Biega National Park. Cartography and Land Use Change of World Heritage Areas and the Benefits of Remote Sensing and GIS for Conservation. Assessing and Monitoring Vegetation in Nabq Protected Area, South Sinai, Egypt, using combine approach of Satellite Imagery and Land Surveys. Evaluation of forage resources in semi-arid savannah environments with satellite imagery: contribution to the management of a protected area (Nakuru National Park) in Kenya. SOGHA, the Surveillance of Gorilla Habitat in World Heritage sites using Space Technologies. Application of Remote Sensing to monitor the Mont-Saint-Michel Bay (France). Application of Remote Sensing & GIS for the Conservation of Natural and Cultural Heritage Sites of the Southern Province of Sri Lanka. Social and Environmental monitoring of a UNESCO Biosphere Reserve: Case Study over the Vosges du Nord and Pfalzerwald Parks using Corona and Spot Imagery. Satellite Remote Sensing as tool to Monitor Indian Reservation in the Brazilian Amazonia. Remote Sensing and GIS Technology for Monitoring UNESCO World Heritage Sites - A Pilot Project. Urban Green Spaces: Modern Heritage. Monitoring of the technical condition of the St. Sophia Cathedral and related monastic buildings in Kiev with Space Applications, geo-positioning systems and GIS tools. The Murghab delta palaeochannel Reconstruction on the Basis of Remote Sensing from Space. Acquisition, Registration and Application of IKONOS Space Imagery for the cultural World Heritage site at Mew, Turkmenistan. Remote Sensing and VR applications for the reconstruction of archaeological landscapes. Archaeology through Space: Experience in Indian Subcontinent. The creation of a GIS Archaeological Site Location Catalogue in Yucatan: A Tool to preserve its Cultural Heritage. Mapping the Ancient Anasazi Roads of Southeast Utah. Remote Sensing and GIS Technology for Identification of Conservation and Heritage sites in Urban Planning. Mapping Angkor: For a new appraisal of the Angkor region. Angkor and radar imaging: seeing a vast pre-industrial low-density, dispersed urban complex. Technical and methodological aspects of archaeological CRM integrating high resolution satellite imagery. The contribution of satellite imagery to archaeological survey: an example from western Syria. The use of satellite images, digital elevation models and ground truth for the monitoring of land degradation in the "Cinque Terre" National park. Remote Sensing and GIS Applications for Protection and Conservation of World Heritage Site on the coast - Case Study of Tamil Nadu Coast, India. Multispectral high resolution satellite imagery in combination with "traditional" remote sensing and ground survey methods to the study of archaeological landscapes. The case study of Tuscany. Use of Remotely-Sensed Imagery in Cultural Landscape. Characterisation at Fort Hood, Texas. Heritage Learning and Data Collection: Biodiversity & Heritage Conservation through Collaborative Monitoring & Research. A collaborative project by UNESCO's WHC (World Heritage Center) & The GLOBE Program (Global Learning and Observations to Benefit the Environment). Practical Remote Sensing Activities in an Interdisciplinary Master-Level Space Course.

CASI

*Conferences; Aerospace Engineering; Archaeology; Biosphere; Conservation; Environmental Monitoring; Mapping; Satellite Imagery*

**20030016613** Texas Univ., Inst. of Classical Archaeology, Austin, TX USA

**Monitoring the Ancient Countryside: Remote Sensing and GIS at the Chora of Chersonesos (Crimea, Ukraine)**

Trelogan, Jessica, Texas Univ., USA; Crawford, Melba, Center for Space Research, USA; Carter, Joseph, Texas Univ., USA; Book of Abstracts: International Conference on Remote Sensing Applications for Archeological Research and World Heritage Conservation; [2002], pp. 1-2; In English; Also announced as 20030016612; Prepared in coordination with National Preserve of Tauric Chersonesos, Crumea, Ukraine; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

In 1998 the University of Texas Institute of Classical Archaeology, in collaboration with the University of Texas Center for Space Research and the National Preserve of Tauric Chersonesos (Ukraine), began a collaborative project, funded by NASA's Solid Earth and Natural Hazards program, to investigate the use of remotely sensed data for the study and protection of the ancient a cultural territory, or chora, of Chersonesos in Crimea, Ukraine.

Derived from text

*Remote Sensing; Monitors; Protection; Agriculture*

**20030016614** National Centre for Remote Sensing, Cotonou, Benin

**Integration of Remote Sensing and GIS for Management Decision Support in the Pendjari Biosphere Reserve, (Republic of Benin)**

Mama, Vincent Joseph, National Centre for Remote Sensing, Benin; Abdoulaye, Mohamed, Direction des Forets et des Ressources Naturelles, Benin; International Conference on Remote Sensing Applications for Archeological Research and World Heritage Conservation; [2002], pp. 3; In English; Also announced as 20030016612; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Over recent years, remotely sensed data and spatial analysis techniques by providing timely and relatively inexpensive information, has proved useful for inventorying and monitoring of wide-life habitat in protected areas. To investigate on land cover pattern and the land use change in the Pendjari Biosphere Reserve, a time series of satellite imageries including LANDSAT(TM) and SPOT XS were used. Ancillary data were also used. The procedure of mapping land cover land use change involved three stages as follows: (1) data collection, preprocessing and visual interpretation; (2) defining land use land cover types; (3) evaluation of land use change. In addition to land use and land cover mapping, decision support maps were elaborated using GIS. These maps included the following themes. infrastructure, monitoring, plan for protection etc. The Biosphere Reserve of Pendjari is located in the West Northern part of Benin Republic. It constituted of three main parts: The Central part entirely protected (275, 000 ha) is located between two buffer zones: Zone Cynegetique de Pendjari (175, 000ha) and Zone Cynegetique de l'Atacora (122, 000 ha). This complex has been set up as Biosphere Reserve in 1986. This study has demonstrated a method that can help to increase the quality and quantity of information needed for protected area management

Author

*Remote Sensing; Biosphere; Data Acquisition; Mapping*

**20030016615** Geosciences Consultants SARL, Bagneux, France

**Monitoring of Deforestation Invasion in Natural Reserves of Northern Madagascar based on Space Imagery**

Guillande, Richard, Geosciences Consultants SARL, France; International Conference on Remote Sensing Applications for Archeological Research and World Heritage Conservation; [2002], pp. 4; In English; Also announced as 20030016612; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Northern Madagascar concentrate most of the remaining forest of the country. Since a decade, several national parks have been created to preserve the unique fauna and flora of the Madagascar forest ecosystem and save patches of forest from the accelerating deforestation phenomenon. This deforestation is mostly caused by burning of new spaces to produce charcoal and exploit new crops. Northern Madagascar is also affected each year by several hurricanes, some of them highly devastating. Heavy rainfalls on deforested land caused the classical chain of erosion and more powerful floods which destroy each time more the cultivated plain in flat valley bottoms. During spring 2000, three strong hurricanes crossed northern Madagascar and hit seriously the northwestern coast of the Island. Huge surfaces of forest were destroyed and most of valley bottoms were drowned by floods. A monitoring of hurricanes and flood impact on agriculture was designed by GSC for the account of ECHO and CARE MADAGASCAR to experiment the input of satellite imagery for the post-crisis management and reconstruction in terms of lost crop surfaces, damages infrastructures. A set of ERS images acquire before (1995) and after (200) the hurricanes were used. The area correspond to 3 images aligned on the same orbit covering approximately to 35 000 sq km. The multitemporal analysis of the images revealed most of the flood plains and damages areas. The level of detail was not precise enough to reveal the types and level of damages on roads, crops and deduce areas necessitating more assistance than others.

Derived from text

*Agriculture; Damage; Deforestation; Ecosystems; Madagascar; Management Methods*

**20030016616** Ghent Univ., Belgium

**Cartography and Land Use Change of World Heritage Areas and the Benefits of Remote Sensing and GIS for Conservation**

DeMaeyer, Philippe, Ghent Univ., Belgium; Goossens, Rudi, Ghent Univ., Belgium; Vansteenvoort, Liesbeth, Ghent Univ., Belgium; DeMan, Joris, Ghent Univ., Belgium; Gamanya, Ruvimbo, Ghent Univ., Belgium; Beyers, Rene, Wildlife Conservation

Society, USA; Hart, John, Wildlife Conservation Society, USA; International Conference on Remote Sensing Applications for Archaeological Research and World Heritage Conservation; [2002], pp. 5-6; In English; Also announced as 20030016612; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

This paper presents a part of a pilot project that was conducted on the Kivu region in the D.R. Congo and includes the area of the Kahuzi-Biega National Park. For this area, that is difficult to access, no recent covering cartography exists. The aim of this project is to set up a production line for base maps of the area, which can be used for monitoring land use and vegetation changes. In this framework the possibilities of remote sensing data were investigated to produce recent base maps.

Derived from text

*Geographic Information Systems; Remote Sensing; Land Use; Conservation*

**20030016617** Ghent Univ., Belgium

**Cartography and Land Use Change of World Heritage Areas and the Benefits of Remote Sensing and GIS Conservation**

DeMaeyer, Philippe, Ghent Univ., Belgium; DeMan, Joris, Ghent Univ., Belgium; Bogaert, Peter, Ghent Univ., Belgium; Muller, Fabrice, Liege Univ., Belgium; Binard, Marc, Liege Univ., Belgium; Gamanya, Ruvimbo, Ghent Univ., Belgium; International Conference on Remote Sensing Applications for Archeological Research and World Heritage Conservation; [2002], pp. 7-8; In English; Also announced as 20030016612; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

In the framework of a UNESCO/World Heritage Centre pilot project we had to collect Geographic Information System (GIS) and Cartographic data about some selected world heritage areas divided into natural and cultural environments. The selected natural areas are Virunga National Park (Congo), Ha Long Bay (Vietnam) and Niokolo Koba National Park (Senegal). The historical cities are the Marrakech (Morocco) and Warsaw (Poland). The main goal of this project is to create an accessible and popular website with the available GIS and Cartographic data containing three themes. The first theme is the cartographic approach. According to the guidelines of the World Heritage

Derived from text

*Geographic Information Systems; Remote Sensing; Mapping; Land Use; Conservation*

**20030016618** Egyptian Environmental Affairs Agency, Nature Conservation Sector, Egypt

**Assessing and Monitoring Vegetation in Nabq Protected Area, South Sinai, Egypt, using Combined Approach of Satellite Imagery and Land Surveys**

ElAlqamy, Husam, Egyptian Environmental Affairs Agency, Egypt; ElShaer, Hany, Egyptian Environmental Affairs Agency, Egypt; International Conference on Remote Sensing Applications for Archeological Research and World Heritage Conservation; [2002], pp. 9; In English; Also announced as 20030016612; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

As part of the natural reserves network in South Sinai, Nabq Protected area is a distinguished natural reserves because of its unique assemblages of plant communities. Nabq protected area contains about 16 species of plants that are not represented elsewhere in southern Sinai. The most northern community of mangrove *Avicennia marina* in the Red Sea is found on the coast of Nabq in addition to the *Salvadora persica* dunes not found anywhere else in southern Sinai. Dunes are also formed by *Nitraria retusa*. Moreover, smaller areas are covered with communities dominated by *Limonium axillare*. In addition to these a considerable area of sea grasses are recorded on the coast of Nabq in the shallow lagoons formed by the coast line. Vast number of animal species of reptiles and mammals inhabiting these plant communities are relying on them for food and shelter. Therefore, continuous and efficient monitoring effort is necessary to provide an updated status of these floral elements as indicative of the ecosystem condition. Manpower of trained and skilful observers is limited, thus satellite remote sensing is a useful source of information as it provides timely and comprehensive coverage of large areas. Coupled with data gained from land surveys reliable condition of the floral communities could be attained. The purpose of the present work is to identify a procedures for analyzing the satellite images that are able to distinguish between different communities and to determine the approximate areas of these. Land surveys of GPS acquired polygons are used to compare the calculated areas and to provide an estimate of precession to the remote sensing based outputs. Final results are maintained through a GIS to compare with future survey to provide a time series for management purposes.

Author

*Remote Sensing; Monitors; Vegetation; Ecosystems*

**20030016619** Groupement pour le Developpement de la Teledetection Aerospatiale, Ramonville, France

**Evaluation of Forage Resources in Semi-Arid Savannah Environments with Satellite Imagery: Contribution to the Management of a Protected Area (Nakuru National Park) in Kenya**

Ganzin, Nicolas, Groupement pour le Developpement de la Teledetection Aerospatiale, France; Mulama, Martin, Kenya National Agricultural Labs., Kenya; International Conference on Remote Sensing Applications for Archeological Research and World Heritage Conservation; [2002], pp. 10; In English; Also announced as 20030016612; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Protected areas such as national parks and natural reserves contain treasures of both animal and plant biodiversity which must be conserved at all costs. Managing the protected areas is therefore a priority, especially in a modern world with an increasing human population that puts more and more pressure on the remaining preserved natural ecosystems. The management of protected areas and wildlife populations is a complex matter which includes among other aspects, the management of the herbivore feeding resources (natural forage). Most of the National Parks and Reserves of Africa being located in and semi-arid areas, often referred to as savannah ecosystems, the vegetation resources are very variable in time and space, mostly depending on erratic rainfalls. They are therefore also fragile and easily subjected to potential degradation if over-utilised, especially when recurrent droughts occur and limit the grazing and browsing capacity of the land. Degradation mostly corresponds to loss of potential of the land, either by decrease of fertility or by change in floristic composition (resulting in reduced quality of the pastures), phenomena which can lead to desertification in the long run. Adapting the animal load to the capacity of the land is an efficient form of management for conservation, but relevant decisions highly depend on a good and updated knowledge of the resources. The forage available for the wild herbivores therefore represents the baseline information for decision making, especially in protected areas with a limited surface and high herbivore population. Information is nevertheless not easy to access on national parks and reserves. Data on vegetation production can be gathered in the field, but measurements are time consuming, work intensive, costly and not representative in time and space unless done very often and with a high sampling rate. Remote sensing, and especially wide field satellite imagery, offers a cheap, regular and reliable alternative source of data to monitor seasonal vegetation development and estimate forage production quantitatively with a fair accuracy. Satellite images, compared to field sample measurements, offer the advantage of a total geographic coverage which partly solves the problem of representativity in space. With data available since the early 1980's they also offer an appealing solution to take into account the great variability in time. An attempt to generate information from satellite data and contribute to protected areas and wildlife management was done in Kenya in collaboration between GDTA and the Kenya Wildlife Service, under a cooperation initiative of the French Ministry of Foreign Affairs. NOAA AVHRR and SPOT/VEGETATION satellite data were used to compute pasture biomass production estimates in a case study on the management of the Nakuru National Park a small entirely fenced park (no migration possible) with a high herbivore load. Biomass productions were estimated on a seasonal basis for a number of growing seasons, using the well documented Monteith model simulating the photosynthetic process with satellite vegetation indices as a main input. After integration into Geographic Information Systems (GIS), results were further processed in conjunction with ancillary information such as park boundaries and vegetation structure to improve the information's accuracy. Herbivore carrying capacity and total forage production of the park were then derived from the biomass production. Carrying capacity indicated how to adapt the animal load to the potential of the land, taking into account the inter-seasonal variability. Total biomass production was compared to forage requirements for the park estimated from yearly total animal counts carried out by KWS in Nakuru. The accuracy and suitability of the products is discussed, as well as the potential use of the information for decision making, especially when integrated in GIS and mixed with various other sources of information useful for rational management.

Author

*Evaluation; Advanced Very High Resolution Radiometer; Annual Variations; Biological Diversity; Ecosystems; Geographic Information Systems; Vegetation; Wildlife*

**20030016620** European Space Agency. ESRIN, Frascati, Italy

**Surveillance of Gorilla Habitat (SOGHA) using Space Technologies**

Fusco, Luigi, European Space Agency. ESRIN, Italy; Hernandez, Mario, United Nations Educational, Scientific and Cultural Organization, France; Matos, Petro, European Space Agency. ESRIN, Italy; International Conference on Remote Sensing Applications for Archeological Research and World Heritage Conservation; [2002], pp. 11-12; In English; Also announced as 20030016612; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

An 'Open Initiative' in support of the World Heritage Convention was launched by the European Space Agency (ESA) and UNESCO in October 2001. Through this initiative, ESA and other International Space Agencies agreed to support the efforts of States Parties of the World Heritage Convention in the monitoring of World Heritage sites using Space Technologies. Capacity building is the main component of this important initiative. As an initial project, ESA and UNESCO, jointly with the Governments of Rwanda, Uganda and the Democratic Republic of Congo, have decided to make an assessment of the gorilla habitat in Eastern

and Central Africa during the last 10 years. This paper describes the project detailed goals, as well as the expected results for 2002 and for 2003. The World Heritage sites selected for this study cover the national parks of Parc National des Virunga (site classified as 'in danger' located at the Democratic Republic of Congo) and The Bwindi Impenetrable National Park (Uganda). In order to cover the whole areas of gorilla habitat in this region, the study includes additional World Heritage candidate sites: the Parc National des Volcans (Rwanda), and the Mgahinga Gorilla National Park (Uganda). All of the above-mentioned areas host mountain gorillas, the Gorilla b. beringei living in the volcanic region, and a small population of eastern lowland gorilla Gorilla b. graueri. During the last years the region has suffered a series of wars and as a consequence a large arrival of refugees. All these actions have become an enormous threat for the area in particular for the survival of the gorillas. Therefore an overall assessment of the vegetation cover over time is required. This is the scope of the UNESCO and ESA defined SOGHA (Surveillance of Gorilla Habitat) project. Due to the mountainous nature of the terrain, inaccessibility and to the unstable atmospheric conditions over the area preventing the existence of good optical images, combined efforts between different space agencies and organisations working on the field are essential. In order to have direct access to ground data ESA and UNESCO have established a consortium of collaborating institutions. With this consortium the project has direct access to user needs and fieldwork. Currently the International Gorilla Conservation Programme, WWF Africa, The Wildlife Conservation Society, the Institute for Tropical Forest Conservation of Uganda and the University of Ghent have agreed to join efforts in the use of space technologies to strengthen the conservation activities to protect the gorillas in Central and Eastern Africa. In close cooperation with the NGOs (Non Governmental Organizations) and key local users, ESA and UNESCO decided, as a first step, to produce accurate maps of the region integrating available satellite images with ground measurements. In fact, the 1:200,000 map of the Virungas is being elaborated jointly by ESA and the University of Ghent, thanks also to a generous support from the Government of Belgium. The work related specifically with the elaboration of this map is presented in a separate paper in this workshop.

Author

*Conservation; Data Acquisition; Forests; Habitats; Images; Meteorology; Populations; Primates; Wildlife*

**20030016621** Michel de Montaigne Univ., Environnement, Geo-Ingenierie, Imagerie et Developpement, Bordeaux, France

**Application of Remote Sensing to Monitor the Mont-Saint-Michel Bay (France)**

Deroin, Jean-Paul, Michel de Montaigne Univ., France; International Conference on Remote Sensing Applications for Archeological Research and World Heritage Conservation; [2002], pp. 13-14; In English; Also announced as 20030016612; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The coastal sectors of epicontinental shelves such as the English Channel show exceptional tidal amplitudes, with the tidal range often exceeding 10 metres. Thus, in certain areas, the foreshores can be exposed over several hundreds of square kilometers, reaching a maximum during low spring tides. These zones are highly sensitive to the accumulation of sediments, which varies considerably in time and space. In spite of frequent aerial photograph missions, only satellite imagery is capable of providing a regular and global monitoring of the modifications that occur in such an environment. These data have been used for the geological mapping of the region. Satellite scenes cover several thousands of square kilometers and their geometric distortions are easily corrected in optical imagery. The spatial resolution of modern optical sensors is adequate for a cartographic approach to the phenomena. The spectral characteristics, in particular in the IR range, make it possible to obtain information, either directly or through the use of ratios, in the mineral and plant domains. Surveys of the littoral zone by multispectral imagery allows investigation of extensive areas having a purely, or at least predominately, mineral response that is unique in a temperate zone. Moreover, the landscape units are homogeneous over large areas, which is compatible with the pixel size.

Derived from text

*Remote Sensing; Monitors; Distortion; Coasts; Topography; Thematic Mapping*

**20030016622** Central Environmental Authority, Div. of Environmental Management and Assessment, Battaramulla, SRi Lanka  
**Application of Remote Sensing and Geographic Information System (GIS) for the Conservation of Natural and Cultural Heritage Sites of the Southern Province of SRi Lanka**

Fernando, M. J. J., Central Environmental Authority, SRi Lanka; International Conference on Remote Sensing Applications for Archeological Research and World Heritage Conservation; [2002], pp. 15-16; In English; Also announced as 20030016612; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The human population in SRi Lanka is increasing at an alarmingly rapid rate, while food production has not been able to keep pace both in nutritional terms & in terms of quantity. Next to food security, the problem that causes a tremendous pressure on the environment is the sheltering or finding a plot of land to live in. These basic human requirements have been the major reasons for rapid degradation of the environment & the depletion of natural resources that have been going unabated. The challenge of providing adequate productive land for the people to produce their food and livelihood's is in conflict with the need to protect the forest cover, the soil & water relationships, cultural sites & wildlife. The development process too, calls for large areas of land.

It is essential that adequate lands are provided for establishing new industries & factories in order to ensure the economic growth of the country.

Derived from text

*Remote Sensing; Conservation; Earth Resources; Forests*

**20030016623** Service Regional de Traitement d'Image et de Teledetection, Strasbourg, France

**Social and Environmental Monitoring of a Unesco Biosphere Reserve Case Study Over the Vosges Du Nord and Pfalzerwald Parks using Corona and Spot Imagery**

Clandillon, S., Service Regional de Traitement d'Image et de Teledetection, France; Meyer, C., Service Regional de Traitement d'Image et de Teledetection, France; deFraipont, P., Service Regional de Traitement d'Image et de Teledetection, France; International Conference on Remote Sensing Applications for Archeological Research and World Heritage Conservation; [2002], pp. 17; In English; Also announced as 20030016612; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

A densely forested area this mountainous region has witnessed a major reduction in agricultural activity, with many formerly tilled lands being left fallow and gradually being colonised by wooded plants. Consequently, forestation has increased and much land gone wild. This has all occurred since the intensification of agriculture in more favourable areas and the application of the European Union's Common Agricultural Policies. The study area is comprised of sections of the Sauer and Lauter river valleys both of whom cross the Franco-German border and comprises two parks covering the equivalent area of Luxembourg. The park administrations are charged with the thorough reevaluation of the parks' socio-economic activities and natural heritage. They must therefore avail of information relating to past and present landuse and ascertain the dynamics of landuse change within this vast area of approximately 400,000 ha. Encroaching woodlands and wild, scrub strewn landscapes are causing a phenomenon that concerns the management teams namely the closing-in of the landscape, with reduced area to area inter-visibility villages seem even more isolated. Moreover, isolated villages have seen a decrease in population.

Derived from text

*Agriculture; Biosphere; Environmental Monitoring; Imagery; Populations*

**20030016624** Instituto Nacional de Pesquisas Espaciais, Brazilian Inst. on Space Research, Sao Jose dos Campos, Brazil

**Satellite Remote Sensing as a Tool to Monitor Indian Reservation in the Brazilian Amazonia**

Martini, P. R., Instituto Nacional de Pesquisas Espaciais, Brazil; Souza, I. M., Instituto Nacional de Pesquisas Espaciais, Brazil; International Conference on Remote Sensing Applications for Archeological Research and World Heritage Conservation; [2002], pp. 18; In English; Also announced as 20030016612; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The Enawene-nawe Reservation in the Southern margin of the Brazilian Amazonia, State of Mato Grosso was created in the early seventies and is being submitted to deforestation and farming from outsiders according to local NGOs and newspaper statements. In order to know more about the real situation a satellite based Remote Sensing investigation is being undertaken. Multi-temporal images are being used and geo-referenced procedures are being adopted to verify more precisely the land use patterns around and within the Reservation boundaries. Geo-coded and geo-corrected images are being registered to detect the changes in the forest cover. LANDSAT-5 frames collected in 1987 are combined with LANDSAT-7 and CBERS-1 images in order to map deforestation patterns. The current results show that cattle raising patterns are entering the borders the Reservation coming from the Northwest. The Northwest region is occupied by land settlers that left the South of the country in the early eighties. They are now expanding their claims from the city of Juina following the road MT-34 that links the city in the State of Mato Grosso with Vilhena in Rondonia. Their lands are distributed over very high relieved granite-bearing terrains. They have settled for cattle not for cropping and now they are prospecting for gold. They are explorers. The South and Southeast borders of the Reservation are surrounded by extensive crop-fields again occupied by settlers that move from the South of Brazil. These Southern borders are not trespass by the cropping patterns even though that the low relieved morphology help to improve the dissemination of crops inside the Reservation. The Southern settlers are producers not explorers. It can be noted that the land management in the North is rough and hard while the procedures in the South of the Reservation is lighter and more productive. Satellite data collected by LANDSAT and CBERS are giving a date viewing of the region helping to verify the Enawene-nawe Reservation six times every 32 days. They are proving to be the cost-effective data to protect all reservations in the Amazonia as others sites that are asking for protection around the world. Satellite images can be the only easier way to approach preservation to the wild and remote lands of the raging third planet.

Author

*Satellite Observation; Satellite Imagery; Remote Sensing; Deforestation*

**20030016625** Leica Geosystems, Inc., Special Applications, Atlanta, GA USA

**Remote Sensing and GIS Technology for Monitoring UNESCO World Heritage Sites--A Pilot Project**

Holcomb, Derrold, Leica Geosystems, Inc., USA; International Conference on Remote Sensing Applications for Archeological Research and World Heritage Conservation; [2002], pp. 19-20; In English; Also announced as 20030016612; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The use of remote sensing and GIS for various monitoring tasks is well established. Worldwide, agricultural crops, coastal zones and forests, among other subjects, are routinely imaged, classified and even managed using these new technologies. The use of satellite imagery for survey and mapping of archaeological sites has been growing, as has its use in environmental applications. This growth of use and applications is, in part, due to the positive synergy of increasing computer power and decreasing costs of this technology. However, like so much of the IT revolution, these technologies are rapidly advancing in the developed world and little understood in the less developed world and little understood in the less developed regions of the world. Many of the World Heritage Sites (hereafter, Sites) are today under threat due to habitat destruction and human encroachment. And, unfortunately, as time passes these slow losses become the status quo. Some areas are difficult to visit or evaluate due to difficult terrain, natural or manmade disasters or political constraints. An underlying thesis of the World Heritage Sites is that they are everyone's heritage and responsibility. The recent destruction in Bamiyan, Afghanistan, underlines what can happen if the World relinquishes that heritage.

Derived from text

*Agriculture; Archaeology; Destruction; Remote Sensing; Satellite Imagery*

**20030016626** Centre National de la Recherche Scientifique, Strasbourg, France

**Urban Green Spaces: Modern Heritage**

Weber, Christiane, Centre National de la Recherche Scientifique, France; Hirsch, Jacky, Centre National de la Recherche Scientifique, France; Puissant, Anne, Centre National de la Recherche Scientifique, France; Brun, Emmanuelle, Centre National de la Recherche Scientifique, France; Brichtler, Cyrille, Centre National de la Recherche Scientifique, France; International Conference on Remote Sensing Applications for Archaeological Research and World Heritage Conservation; [2002], pp. 21-22; In English; Also announced as 20030016612; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Since 1987, "sustainable development" has appeared under the Brundtland report umbrella and many actions emerged locally to favor a result at a global scale. Several strategies have occurred protecting natural resources (water, air, soils etc.) and attempting to prevent from the anthropogenic threats. As such urban green spaces are considered as a heritage that has to be preserved at the same level as monument or industrial buildings. Environmental issues have placed the urban green areas on the stage. Among the protection decisions, the Agenda 21 initiative for instance, has especially focused on urban environment, land cover-land use change and sustainable urban development. Several cities have promoted green areas development and protection in order to enhance the quality of life of their citizens. The EU community in "the Environment 2010 programme" has stressed upon four thematic domains: climatic change, health, nature and biodiversity, and finally natural resources.

Derived from text

*Biological Diversity; Conservation; Earth Resources; Protection*

**20030016627** Saint Sophia Cathedral, National Architectural and Historical Conservation Area, Kiev, Ukraine

**Monitoring of the Technical Condition of the Saint Sophia Cathedral and Related Monastic Buildings in Kiev with Space Applications, Geo-Positioning Systems and GIS Tools**

Maslov, Y. A., Saint Sophia Cathedral, Ukraine; Dyshlyk, A. P., State Scientific and Production Co., Ukraine; Kojan, E. A., Saint Sophia Cathedral, Ukraine; International Conference on Remote Sensing Applications for Archeological Research and World Heritage Conservation; [2002], pp. 23-24; In English; Also announced as 20030016612; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

In the very historic centre of Kiev towers a Cathedral, which was erected in the first half of the 11th century in honour of Saint Sophia - God's of Wisdom. In 1990 the Saint Sophia Cathedral of the 11th century together with its ensemble of monastic buildings in its territory was included in the UNESCO World Heritage List. The outstanding universal importance of this monument is that the architecture of the Cathedral has been almost completely preserved since the 11th century. Such technology (know-how) has designed now. It uses essentially the data received from satellites, data of a large scale aerial photo shooting, and also data of a spectral shooting. These data will be used in a complex with the data of ground level shooting for development of geopositioning systems to assist in the elaboration of digital topography for historical territory and periodically observation of processes of the buildings deformation by usage of GIS toolkit. The tendered technology includes the following sequence of operations: 1. Creation of a backbone of geodesic points at the territory of the architectural ensemble of the St. Sophia Cathedral with a usage

of GPS. 2. Large scale aerial photo shooting of the territory of the architectural ensemble of the St. Sophia Cathedral. 3. Creation of a network of geodetic points inside ancient buildings. 4. Phototheodolite shooting of facades and interiors of ancient buildings. 5. Photogrammetric fixing of the monumental wall painting inside of the Sofia Cathedral with a usage of photo and total station data. 6. Observation over the top motion of the Bell Tower and cupolas motion of the Sofia Cathedral with a usage of the aerial photo data. 7. Developing the facilities and skills-base required to store, process and facilitate the usage of all data for the deformation analysis and decisions making.

Derived from text

*Aerial Photography; Aerial Reconnaissance; Histories; Photogrammetry; Technology Utilization*

**20030016628** Bologna Univ., Dept. of Archaeology, Italy

**The Murghab Delta Palaeochannel Reconstruction on the Basis of Remote Sensing from Space**

Barbara, Cerasetti, Bologna Univ., Italy; International Conference on Remote Sensing Applications for Archeological Research and World Heritage Conservation; [2002], pp. 25-26; In English; Also announced as 20030016612; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The aim of the present research is the reconstruction of the palaeochannel network of the Murghab delta (Turkmenistan) and the water supply process of the major sites, using Remote Sensing data like satellite imagery (CORONA 1964 - LANDSAT-7 2001) integrated by other vertical platforms like air photos. The integration of the resulting data with the GIS of the area will be used to reconstruct the settlement distribution in a virtual archaeological landscape of the Murghab delta and to understand the complex processes characterizing the culture development in that area and in the neighbor regions from 3000 BC to XIII century AD.

Derived from text

*Aerial Photography; Archaeology; Remote Sensing; Satellite Observation; Topography*

**20030016629** New Brunswick Univ., Dept. of Geodesy and Geomatics Engineering, Fredericton, New Brunswick Canada

**Acquisition, Registration and Application of IKONOS Space Imagery for the Cultural World Heritage Site at Merv, Turkmenistan**

Dare, Peter, New Brunswick Univ., Canada; Herrmann, Georgina, University Coll., UK; Williams, Tim, University Coll., UK; Ziebart, Marek, University Coll., UK; International Conference on Remote Sensing Applications for Archeological Research and World Heritage Conservation; [2002], pp. 27-28; In English; Also announced as 20030016612; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The Merv oasis lies astride one of the main arms of the ancient Silk Roads that traversed half the world, from the Far East to Europe and Africa. The ancient cities of Merv, a succession of flourishing administrative and trading centres for nearly 1,700 years, became one of the most important cultural centres in the Islamic world. The Turkmenistan Ministry of Culture made the far-sighted decision in 1990 to establish an Archaeological Park to protect the walled cities and the principal outlying monuments within the oasis. This has already done much to improve the basic condition of the cities, removing modern agriculture from within the walled areas, and generally improving access to the monuments. However, there are daunting conservation issues facing the Turkmens. In 1999 the site was declared a World Heritage Site and in 2000 Merv was placed on the list of the world's 100 most threatened sites by World Monuments Watch it remains on that list today. Panchromatic 1 m-resolution imagery for the site area was acquired from the IKONOS satellite during 2001. The acquisition epoch for the black-and-white data was selected to minimise masking due to vegetation and cloud cover. The precise locations of points of detail in the imagery, required for spatial registration of the remote sensing data, were determined by a Global Positioning System observation campaign. These locations were computed using the globally consistent International Terrestrial Reference Frame and projected using the appropriate Universal Transverse Mercator zone. The fieldwork, computational procedures and reasons for choice of reference frame and projection are described. The results of the spatial registration, and their implications for the accuracy of the mapping data are discussed. The cities of Merv have been the subject of many years of investigation, including fieldwalking, geophysical surveying, detailed archaeological excavation, and building recording. Future work will include further excavation, geophysical and topographic survey, aerial photography, conservation and the monitoring. The satellite imagery provided the basis by which all the disparate elements undertaken thus far could be integrated into a single spatial framework, and a means by which all future work could be co-ordinated. The image also provides an important record of the condition of the site at a point in time. Given the scale of the ancient cities of Merv (c 1,000 ha of enclosed urban space, with additional extensive suburban activities), the field monitoring of every track, pathway, drainage channel, field, erosion gully, etc, would be a huge undertaking. The satellite image provides a comprehensive base map that enables these aspects to be rapidly and accurately documented, and future changes to be measured. The geo-referenced image has provided, for the first time at Merv, a base map capable as acting as the platform for integrating and acquiring spatial data, providing the platform for the development of a GIS for the Archaeological Park. This

project demonstrates how several rapidly developing branches of technology can be brought to bear on the management and analysis of a site of international importance in a cost-effective and efficient manner. These technologies are great enablers, and although the acquisition and registration of the data are quite complex tasks, the final product, in the form of a digital map base, is readily accessible to archaeologists and other heritage management professionals.

Author

*Satellite Imagery; Spaceborne Photography; Conservation; Surveys*

**20030016630** Centre National de la Recherche Scientifique, Roma, France

**Remote Sensing and VR Applications for the Reconstruction of Archaeological Landscapes**

Forte, Maurizio, Centre National de la Recherche Scientifique, France; International Conference on Remote Sensing Applications for Archeological Research and World Heritage Conservation; [2002], pp. 29-30; In English; Also announced as 20030016612; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Knowledge and diachronic interpretation of an archaeological landscape depends on factors of perception, self-referring, interaction ("feedback") and cultural learning. The paper describes a new approach for the reconstruction of archaeological landscapes using virtual reality technologies, remote sensing techniques and GIS data within an eco-environment of simulation. "Landscape ecology is a branch of modern ecology that deals with the relationships between man and his open and built-up landscapes". The landscape classification of Naveh and Lieberman is the following: 1. Ecotope (or site), smallest holistic land unit, characterized by homogeneity of the least one land attribute of the geosphere-namely, atmosphere, vegetation, soil, rock, water, and so on, with non excessive variations in other attributes. 2. The land facet (or microchore), a combination of ecotopes, forming a pattern of spatial relationships and being strongly related to properties of at least one land attribute (mainly landform). 3. The land system (or mesochore) is a combination of land facets that form one convenient mapping unit on reconnaissance scale. 4. The main landscape (or macrochore) is a combination of land systems in one geographical region What space does the archaeology occupy within the landscape?

Author

*Remote Sensing; Virtual Reality; Archaeology; Landforms; Topography*

**20030016631** Indian Space Research Organization, Forestry, Land Use and Photogrammetry Group, Ahmedabad, India

**Archaeology Through Space: Experience in Indian Subcontinent**

Thakker, P. S., Indian Space Research Organization, India; International Conference on Remote Sensing Applications for Archeological Research and World Heritage Conservation; [2002], pp. 31; In English; Also announced as 20030016612; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The emergence of our own species remains one of the most elusive problems in palaeo anthropology. According to Arch Bishop Usshers' chronology man was created in 4004 B. C. on March 23rd. The total age of man and also of the earth was just about a few thousand years as per the story of Adam and Eve according to western theory. In the east, the people, particularly Hindus, believed that man existed on the earth since countless ages. Man has lived on this planet for more than a million years (perhaps even much longer) and yet this fact was not known to us till just about a hundred and fifty years from now. Prehistoric man lived mostly on the banks of the rivers so that he could easily avail of one of the necessities of life, the water. At the time of the floods he left the riverside, but in the process of leaving he left behind inadvertently his belongings and imperishable stone implements. Gradually as the water receded these implements got stuck or embedded in the clay. As this process was repeated again and again, a variety of stone tools made by prehistoric man were left behind in the terraces of riverbeds. It is they that provide clues to his antiquity.

Derived from text

*Archaeology; Chronology; Remote Sensors; Spaceborne Photography*

**20030016632** Instituto Nacional de Antropologia e Historia, Yucatan, Mexico

**The Creation of a GIS Archaeological Site Location Catalogue in Yucatan: A Tool to Preserve Its Cultural Heritage**

Herrera, Jose Huchim, Instituto Nacional de Antropologia e Historia, Mexico; Torres, Diana Trejo, Instituto Nacional de Antropologia e Historia, Mexico; Covarrubias, Miguel, Instituto Nacional de Antropologia e Historia, Mexico; International Conference on Remote Sensing Applications for Archeological Research and World Heritage Conservation; [2002], pp. 32-33; In English; Also announced as 20030016612; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Archaeological site location and registration in the Northern Maya Lowlands of the Yucatan Peninsula has been an interrupted process, despite the fact that in the past there have been numerous regional projects focused on locating and documenting characteristics of prehispanic settlements. During the development of a later project, called INAH-PROCEDE Yucatan all the

information of former investigations and that produced by the project itself, were unified in a single data base, which now contains more than 1,970 records (one for each site). An important data corpus about Maya archaeological site locations was created, divided into three kinds of files: 1) Catalogue of Yucatan's Archaeological Site Location (data base file). 2) Topographic maps covering the entire Yucatan State with site locations indicated on them, as well as polygons for surveyed sites and contemporary land tenure where they are located. 3) Individual files with polygons that establish protected areas for more than 200 sites surveyed and complementary information about each one.

Derived from text

*Geological Surveys; Archaeology; Catalogs (Publications); Preserving*

**20030016633** George Washington Univ., Washington, DC USA

**Mapping the Ancient Anasazi Roads of Southeast Utah**

Williamson, Ray A., George Washington Univ., USA; Jeffe, Michael, George Washington Univ., USA; Hurst, Winston, College of Southern Utah, USA; International Conference on Remote Sensing Applications for Archeological Research and World Heritage Conservation; [2002], pp. 34-35; In English; Also announced as 20030016612; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

About a decade ago archaeologists became aware for the first time of the existence of Ancestral Pueblo (Anasazi) roadways within the canyons of Southeast Utah. By walking many miles of canyon landscape, they have tentatively identified an extensive network of "road" segments—well-defined pathways up to 10 meters wide—connecting the major Anasazi settlements of Southeast Utah. The discovery of road network, which now total over 100 kilometers in length, led to the identification of other previously unknown archaeological sites associated with it. These include nearly two dozen shallow depressions up to 20 meters in diameter, likely to contain the remains of large ceremonial rooms (great kivas) typical of the late 11th and early 12th century AD Ancestral Pueblo culture. The road network, which resembles the Ancestral Pueblo roads in and near Chaco Canyon, New Mexico, has never been fully delineated, in large part because of the extensive labor involved to verify the road segments on foot, but also because they are often too shallow to see from ground level. Because these features extend over a wide geographical expanse, remote sensing from spacecraft is an ideal technique for mapping them, preparatory to detailed ground examination. This paper describes the use of high-resolution Ikonos satellite imagery to document the roads and the significant archaeological features found along or near them. It also explores the use of these techniques for managing significant cultural landscapes in the face of substantial destructive pressures. The project employed a combination of intensive ground examination using a digital video system incorporating precise geographic coordinates by means of the Global Positioning System (GPS). We used the GPS-video camera not only to record the appearance and position of road segments, but also to document natural landscape features but also each item of archaeological significance associated with them. Archaeological features include simple rock circles, herraduras (thought to be ceremonial features), small and large dwellings, great kivas, and rock art sites. This technology allowed for the first time the rapid acquisition and incorporation of varied types of natural and archaeological data into digital databases. Further, because position data were acquired as an integral part of the data collection process, they were readily incorporated into the geographic information system (GIS) that we used in analyzing and displaying the satellite data.

Author

*Mapping; Archaeology; Cameras; Data Acquisition; Geographic Information Systems; Remote Sensing; Satellite Imagery*

**20030016634** Kolkata Metropolitan Development, Dept. of Planning, Kolkata, India

**Remote Sensing and GIS Technology for Identification of Conservation and Heritage Sites in Urban Planning**

Som, Nisitendra Nath, Kolkata Metropolitan Development, India; International Conference on Remote Sensing Applications for Archeological Research and World Heritage Conservation; [2002], pp. 36-37; In English; Also announced as 20030016612; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Documenting cultural landscapes around the objects of cultural heritage has often been neglected because of the high surveying and mapping expenditure. With modern techniques documentation has become cost effective, which can be a powerful means to monitor and manage conservation and development of heritage sites. Remote sensing technology through the use of aerial photographs and satellite images could be used to identify sufficient details even the boundary walls of archaeological sites, which are otherwise difficult to identify from the ground. Inherent properties of remote sensing image make the data derived from it extremely useful in building a broad base, namely: (a) the wider environmental perspective provided by remote sensing techniques than ground surveys, and (b) the imagery provides a perspective of increasing historical value over fixed time and space. This may be a recent approach towards the study of archaeological and historical sites, that integrates information of all the techniques available to restore, preserve, and discover any unknown remains of archaeological and cultural importance. It is believed that the new technology will save time, budget, and human resource to discover unknown archaeological sites. In India

fascinating history, supported by geological, hydrological and archaeological evidences of heritage as well as the application of most modern tools, such as remote sensing and GIS could be revealed.

Derived from text

*Remote Sensing; Geological Surveys; Aerial Photography; Archaeology; Urban Planning*

**20030016635** Ecole Francaise d'Extreme-Orient, French Inst. of East Asian Studies, Phnom Penh, Cambodia

**Mapping Angkor: For a New Appraisal of the Angkor Region**

Pottier, Christophe, Ecole Francaise d'Extreme-Orient, Cambodia; International Conference on Remote Sensing Applications for Archeological Research and World Heritage Conservation; [2002], pp. 38; In English; Also announced as 20030016612; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Dr. Pottier, Member of the EFEO, based in Angkor (Cambodia) since 1992, will present various results of the research he conducted on ancient urban planning in Angkor region. His research initiated with his participation to the ZEMP (Zoning and Environmental Management Plan for Angkor Region), a multi-disciplinary study organized by UNESCO for the inscription of Angkor on the World Heritage list. Analysing the impact of future developments on archaeological and architectural sites conducted him to build on a new cartography of these numerous sites. Bad security conditions and landmines restricting at that time any possibility for ground inspections, this first mapping of the whole region has been made possible with the use of a recent Finnish aerial photographs. The most astonishing result has been the identification of hundreds of "new" archaeological sites, recording finally around twice the number of sites one would have expected with previous inventories. High density of sites sprayed in the whole region showed a new light on how Angkor was organized and deeply integrated in its environment, opening new and promising opportunities of research on a key subject. Since 1993, Dr. Pottier developed this preliminary study into an extensive research, first focusing on the central and south area of Angkor (600sqm), completing a new archaeological map crossing information from existing archives, remote sensing and systematic GPS ground checking. During this first phase, more than 500 archaeological sites and features have been inventoried and precisely mapped. 60% of these sites being previously unknown, the mapping offered a new appraisal of territorial management, urban planning and chronological sequences. A second phase is in progress since 1999 in collaboration with the University of Sydney, combining GIS and a September 2000 airborne radar (AIRSAR NASA/JPL) of the entire region of Angkor. This new remote sensing tool doesn't replace the aerial photographs, but it shows clearly that great detail could be acquired from aerial radar both on features, such as ancient rice fields which can be seen in the aerial photograph, but also on environmental phenomena such as partially concealed water flow and on vegetation regimes. Most important, it offers an observer an integrated view in which scattered parts of a whole become understandable as one phenomenon. The ongoing project is actually focusing on the analysis of the radar, combined with the older aerial photographs and fieldwork where safe, concentrating on the area north of Angkor in order to complete a comprehensive new plan of Angkor, an gigantic low density and open city stretched across the thousand square kilometers of the area inscribed on the World Heritage list.

Derived from text

*Aerial Photography; Archaeology; Management Planning; Mapping; Photographs; Remote Sensing*

**20030016636** Sydney Univ., Dept. of Archaeology, Australia

**Angkor and Radar Imaging: Seeing a Vast Pre-Industrial, Low-Density, Dispersed Urban Complex**

Fletcher, Roland, Sydney Univ., Australia; International Conference on Remote Sensing Applications for Archaeological Research and World Heritage Conservation; [2002], pp. 39; In English; Also announced as 20030016612; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

An AIRSAR radar survey in September 2000 of 3000 sq km of the region around central Angkor in Cambodia has revealed that the urban complex covered approximately 1000 sq km with most of the major temples located within the central 200 sq km. The radar survey completed by NASA/JPL for the Greater Angkor Project has now shown that a network of roads and canals extends for at least 15-20 km out from the centre. It overlies but does not mesh with the dispersed distribution of inter-visible residential mounds and local shrines that was first identified by Christophe Pottier of EFEO in the mid 1990s. The radar has also revealed local shrines and occupation sites on the lower slopes of the Kulen hills far away from the centre of Angkor. The radar shows that Angkor was the largest, low-density, dispersed pre-industrial urban complex. This has substantial implications for the interpretation and conservation of Angkor.

Author

*Surveys; Synthetic Aperture Radar; Cambodia*

**20030016637** Durham Univ., Dept. of Archaeology, UK

**Technical and Methodological Aspects of Archaeological CRM Integrating High Resolution Satellite Imagery**

Beck, Anthony, Durham Univ., UK; International Conference on Remote Sensing Applications for Archeological Research and World Heritage Conservation; [2002], pp. 40; In English; Also announced as 20030016612; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Until recently the spatial resolving characteristics of satellites were too crude for archaeological site prospection although sensor systems such as LANDSAT did provide contextual thematic data. However, declassification of historic military imagery (the American Corona and the Russian KVR missions) and high resolution commercial satellite systems (such as Ikonos and Quickbird) provide archaeologists with satellite imagery that can be used for both site prospection and Cultural Resource Management (CW). Satellite imagery can provide an informative backdrop for archaeological landscape studies, particularly those where the archaeological resource is poorly understood or accessing contemporary or historic landscape information can be difficult. This is the case for the Settlement and Landscape Development Project in the Homs Region, Syria (SHR). Typical of many parts of the developing world, there is neither a systematic regional database of archaeological remains, ready access to topographic mapping at scales greater than 1:50,000, nor is aerial-photography available. This provides a variety of challenges for archaeological research and management which can, in part, be addressed by the utilisation of satellite imagery. This paper will outline the technical and methodological issues in integrating and analysing these different data sets. Issues such as creating CFW data infrastructures, ground observation (using integrated GPS recording), image preparation and geolocation, spatial and a-spatial analyses using GIS and the future potential of the satellite systems will all be addressed.

Author

*Satellite Imagery; Resources Management; Archaeology; Global Positioning System; High Resolution*

**20030016638** Durham Univ., Dept. of Archaeology, UK

**The Contribution of Satellite Imagery to Archaeological Survey: An Example from Western Syria**

Philip, Graham, Durham Univ., UK; International Conference on Remote Sensing Applications for Archeological Research and World Heritage Conservation; [2002], pp. 41; In English; Also announced as 20030016612; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The paper will discuss the value of imagery for: 1. The provision of environmental data, through which the landscape context of past human activity can be explored 2. The monitoring of landscape change, and the identification of threats 3. The development of refined sampling strategies, for example by enabling the estimation of the effects of masking of ground-surface by vegetation 4. The location and mapping of different kinds of sites and structures The paper will also report upon the results of the field-testing of intensive surface collection undertaken to identify those categories of archaeological remains which are less readily identified using imagery, and on the physical and geochemical characteristics of those plough-soil scatters which are most apparent using panchromatic imagery. The paper will conclude with a brief overview of the way in which imagery has been integrated with other forms of spatial and aspatial data within the project GIs, in order to provide a multidimensional desktop resource, and a quantifications of the costs involved, in terms fo imagery, software and the input of staff-time.

Derived from text

*Satellite Imagery; Archaeology; Environment Effects; Data Acquisition; Mapping; Topography*

**20030016639** Joint Research Centre of the European Communities, Inst. for Environmental and Sustainability, Ispra, Italy

**The Use of Satellite Images, Digital Elevation Models and Ground Truth for the Monitoring of Land Degradation in the "Cinque Terre" National Park**

Montanarella, L., Joint Research Centre of the European Communities, Italy; Rusco, E., Joint Research Centre of the European Communities, Italy; Salina, F., Joint Research Centre of the European Communities, Italy; Besio, M., Genoa Univ., Italy; International Conference on Remote Sensing Applications for Archeological Research and World Heritage Conservation; [2002], pp. 42; In English; Also announced as 20030016612; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The area of the Cinque Terre (five lands) includes the five communes of Levanto, Monterosso Vernazza, Riomaggiore e La Spezia. Since 1997 it is classified as a UNESCO world heritage site. The Committee decided to inscribe this site considering that the eastern Ligurian Riviera between Cinque Terre and Portovenere is a cultural site of outstanding value, representing the harmonious interaction between people and nature to produce a landscape of exceptional scenic quality that illustrates a traditional way of life that has existed for a thousand years and continues to play an important socio-economic role in the life of the community. A unique characteristic of the area are the terraced vineyards sustained by dry walling, a perfect example of landscape architecture created by man in inaccessible surroundings. The recently created National park, has as one of its main tasks to develop strategies for the protection of this cultural heritage. Land abandonment is threatening the stability of the terraced areas,

leading to extensive soil erosion and landslides. A shifting economy from agriculture to mass tourism is at the origin of these negative trends. The development of options for a sustainable tourism in the area requires also a constant monitoring of this very fragile landscape. High resolution satellite imagery (IKONOS) can provide a valuable tool for the monitoring of land use changes and consequent land degradation phenomena. The combined use with detailed digital elevation models and ground truth can also identify major areas at risk of slope instability. A prototype system for the regular monitoring of land degradation in the area of the National park will be presented.

Author

*Satellite Imagery; Landslides; Degradation; Digital Elevation Models; Escape (Abandonment); Soil Erosion*

**20030016640** Madras Univ., Dept. of Applied Geology, India

**Remote Sensing and GIS Applications for Protection and Conservation of World Heritage Site on the Coast - Case Study of Tamil Nadu Coast, India**

Krishnamoorthy, R., Madras Univ., India; Bharathi, G. Sachidanantha, Madras Univ., India; Periakali, P., Madras Univ., India; International Conference on Remote Sensing Applications for Archaeological Research and World Heritage Conservation; [2002], pp. 43; In English; Also announced as 20030016612; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

More than 1000 km length coastline of Tamil Nadu in Southeast India is very important due to its unique character of housing important coastal ecosystems, tourism centers, protected areas such as marine biosphere reserve, UNESCO's World Heritage site, etc. Considerable amount of studies are carried out for Tamil Nadu coastal zone to estimate its resource potential including the preparation of Integrated Coastal Zone Management strategy using remote sensing and GIS technology tools. The present study is focused to the 60 km length coastline just below the Chennai (Madras) capital of Tamil Nadu State where the World Heritage Site - Mahabalipuram is located. The shore temples of Mahabalipuram was built by an emperor of the Pallava dynasty in seventh century AD are recognized as UNESCO's World Heritage Site. Due to various coastal zone issues/problems especially the human activities and biophysical processes are found to be severe threat to protect this heritage site. Severe shoreline erosion, land use changes due to growth of urban centers and tourism activities around this site and pollution due to unsustainable tourism and industries are the main underlying causes for the damage to this heritage site. In the study the areas of severe shoreline erosion, changes in shoreline configuration, coastal geomorphology, change-detection of land use pattern are studied in detail using multirate multisensors remote sensing data particularly the Indian Remote Sensing Satellite (IRS) data together with the analysis of spatial data using a Geographical Information System (GIS). The coastal zone information derived from remote sensing platforms are found to be more useful to protect this heritage site and also monitor the damages. The areas of severe shoreline erosion has been demarcated using the GIS overlay analysis. The Coastal Zone Information System (CZIS) created using GIS is found to be more suitable for coastal managers and planners to conserve this heritage site. This study also highlights the important benefits of high spatial resolution sensors data such as IRS-LISS-III and TM for the quantitative studies on various coastal environmental problems, which has direct impact on the heritage site located on the coastal zone. The protection and conservation of this heritage site could be possible only through the implementation of people oriented Integrated Coastal Zone Management plan where the main information source is space technology. The salient results obtained from this study concludes that the remote sensing and GIS applications are very vital in protection and conservation of heritage sites located on the coastal zone where high population pressure, economic activities, rapid industrial development and tourism activities are taking place.

Author

*Remote Sensing; Geological Surveys; Biosphere; Coastal Ecology; Conservation; Ecosystems; Environment Management; Satellite Observation*

**20030016641** Siena Univ., Dept. of Archaeology and History of Arts, Italy

**Multispectral High Resolution Satellite Imagery in Combination with "Traditional" Remote Sensing and Ground Survey Methods to the Study of Archaeological Landscapes. The Case Study of Tuscany**

Francovich, Riccardo, Siena Univ., Italy; Campana, Stefano, Siena Univ., Italy; International Conference on Remote Sensing Applications for Archeological Research and World Heritage Conservation; [2002], pp. 44-45; In English; Also announced as 20030016612; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

There is increased interest today in making scientific progress through the use of remotely sensed data in social science research. On this topic it is important to remember that remote sensing is not a new technology. Archaeological studies have a long tradition of aerial photography application, from the earliest air photographs taken from balloons at the end of XIXth century to the crucial works of O.G.S. Crawford and many others aerial archaeologists, until the actually National Mapping Programmes. What is changed in recent years about remote sensing application it is the development of new sensors (in particular multi-spectral, hyper-spectral, microwave) and the availability of new tools for the management and for the integration of spatial information.

The Department of Medieval Archaeology at the University of Siena has been actively engaged in programmes of landscape archaeology for over thirty years. Territorial studies have been based for the most part on three methodologies of investigation: field survey in sample areas (with 20-30% of the total landscape and replicated collection); field examination to assess the significance of individual monuments (known roman villa, medieval castles, churches, etc.); and analysis of vertical air photos combined with selective ground-truthing, in the last ten years one of the principal scientific objectives in the research programmes of the Department of Medieval Archaeology has been achieved through the construction of a management system for all of the archaeological information. Since the end of 1998 we turned the attention to increase our experience in remote sensing techniques. Within the Department of Medieval Archaeology, the Laboratory of Aerial Photographic Interpretation has been active since 1984. The Laboratory is dedicated to the stereoscopic examination of vertical aerial photographs and in twenty years it has carried out numerous research projects, leading to the identification of over 5000 air-photo anomalies in Tuscany alone. Despite good archaeological results, we have been conscious throughout of the inherent limitations of this method of survey. The main problem is the cartographic nature of the data and the impossibility of planning the flights to coincide with times when conditions for the detection of archaeological features are at their best. In addition, there are other problems with vertical photographs, such as the inherent inflexibility of paper documents, the difficulties of magnifying details, and the limited capacity to distinguish between tones of grey, etc. to try and overcome these limitations in pursuit of our own objectives we have changed our focus to the experimental application and evaluation of new techniques in the study of the Tuscan landscape. After looking at experience elsewhere, we realized that there was not an ideal technique able to exclude all the others. Each data source has its imperfections. In short we started from known concepts summarized by Lillesand and Kiefer as "more information is obtained by analysing multiple views of the terrain than by analysis of any single view" and that "successful application of remote sensing is premised on the integration of multiple, interrelated data sources and analysis procedures". This is the reason why we turned to oblique aerial photography, to the latest generation of multi-spectral high-resolution satellite imagery (Ikonos-2 and QuickBird-2), to geophysical survey and to micro-digital terrain modelling using differential GPS. Our progress in developing this approach can be highlighted by looking at five sample areas, representative of the landscape complexities and settlement patterns of Tuscany. The total extent of these sample areas is around 670 square km. All areas have recently been the subject of numerous socio-archaeological studies, field-walking surveys, excavations, vertical air-photo interpretation, geological and geomorphologic analysis. When setting up the research project we paid particularly close attention to the systematic collection of data. The first methodological objective of the operation was to arrange the greatest possible number of elements for comparison - using GIS technology - with satellite imagery and with oblique aerial photographs. In a second stage it will be useful to integrate the whole information and propose new settlement patterns. The methodological approach to Ikonos-2 and QuickBird-2 imagery has been focused on 2D visual interpretation and the exploration of 3D representations. The procedure followed in processing the Ikonos-2 imagery falls into two main phases, both taking into consideration the existing remote sensing techniques. The first phase consists of a series of standard transformations of the whole image. In this stage of the processing some of the most commonly used techniques have been contrast stretching, density slicing, RGB colour composites of the original bands (3-2-1; 4-3-2; 4-2-1; 3-4-1) and arithmetic manipulation, in particular averaging (to reduce the noise component) and rationing (especially Normalized Difference Vegetation Index). At the second phase of image processing, the focus of view was narrowed in order to isolate homogeneous textures around individual anomalies. The processing was carried out using Principle Component Analysis (PCA), Tasseled Cap Transformation (TCT), Decorrelation Stretch (DS) and RGB colour composites of the results of the various transformations. On completion of the image processing we are able to recognize some trends. As we expected, all of the best results come from transformations in which the near infrared band plays a primary role, especially in NDVI, Principal Component Analyses, brightness and Wetness Transformation and relative colour composites. Certainly there is no single ideal technique, but rather a spectrum of techniques producing variable results. An approach based on visual detection is affected by subjectivity, and the perception of anomalies varies from individual to individual. to tackle this problem we are developing supervised classification of the image data. to overcome the limitation of the high correlation between the Ikonos-2 bands we have recently been trying to apply a classification using synthetic imagery PC1, PC2, PC3 and PC4. We now believe that an alternative and perhaps better approach to data interpretation should also be taken into consideration. A second procedure that we are currently testing is based on good results obtained with Wetness transformation. It is known that a textural discrimination based on soil wetness is strictly season-dependent, and any procedure used to map different deposits from remotely sensed data fails when the acquisition time is not appropriate. The proper time is generally different for the various sediments in a study area. Hence the need for a multi-temporal approach. The evaluation and use of Ikonos-2 imagery, oblique aerial photography, geophysics and differential GPS forms part of a wider strategy aimed at understanding the peculiarity of every single source so that we can on each occasion employ the appropriate combination of remote sensing techniques to maximize our understanding of the ancient landscape. By applying multistage sensing techniques to our landscape projects we are beginning to develop a system of modular prospecting. Starting from a broad over-view of the survey area, we move through a series of steps, ultimately to a level of detailed definition. The use of different data-sources allows us to work at a variety of spatial resolutions. But it also introduces two other key factors:

spectral and temporal resolution. "Spectral resolution" refers to those parts of the electromagnetic spectrum that are employed in each technique: black-and-white panchromatic for vertical photography, colour or near infrared for oblique photography, and blue/gree/red/near-infrared for Ikonos-2 satellite imagery. Even at this early stage we can say that the introduction of this approach to landscape analysis, running hand in hand with continuing programmes of field-waking, has transformed both our way of working and our understanding of ancient landscapes increasing the value and impact of our research.

Author

*High Resolution; Satellite Imagery; Remote Sensing; Surveys; Archaeology; Topography*

**20030016642** Birmingham Univ., Field Archaeology Unit, UK

**The Use of Remotely-Sensed Imagery in Cultural Landscape Characterisation at Fort Hood, Texas**

Barratt, Glynn, Birmingham Univ., UK; Dingwall, Lucie, Birmingham Univ., UK; Fitch, Simon, Birmingham Univ., UK; Huckerby, Cheryl, III Corps and Fort Hood, USA; International Conference on Remote Sensing Applications for Archeological Research and World Heritage Conservation; [2002], pp. 46-47; In English; Also announced as 20030016612; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The Fort Hood Cultural Landscape Characterisation Project is utilising an approach to archaeological assessment known as cultural landscape characterisation to provide a framework for cultural resource management (CRM) at Fort Hood, a large military training facility in Central Texas, USA. The project is based around the use of remotely-sensed data and GIS technology, using LANDSAT TM satellite imagery as the primary data source for the initial identification and mapping of the landscape types, supported by aerial photographic cover, digital environmental data including elevation, geology and soils, existing land cover data, historic mapping, databases of recorded archaeological sites and ground truthing in the field using GPS. All the data is stored and manipulated within a single project GIS, which will allow full integration with the rest of the CFW programme, and with other environmental management programmes at Fort Hood.

Derived from text

*Remote Sensing; Resources Management; Archaeology; Cultural Resources; Elevation; Terrain*

**20030016643** United Nations Educational, Scientific and Cultural Organization, World Heritage Center, Paris, France

**Heritage Learning and Data Collection: World Heritage, Environmental Education and Bridging the Digital Divide**

Ishwaran, Natarajan, United Nations Educational, Scientific and Cultural Organization, France; Stone, Randi L., Globe Program, USA; International Conference on Remote Sensing Applications for Archeological Research and World Heritage Conservation; [2002], pp. 48-50; In English; Also announced as 20030016612; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

This collaborative effort capitalizes on UNESCO's World Heritage Network of sites, site managers and schools, and on the GLOBE Program's international network of primary and secondary school students and teachers and principal investigators. Project participants take GPS measurements of the sites and collect Earth Science data -- Atmosphere/Climate; Hydrology; Land Cover/Biology & Biodiversity; Soils; PhenologyE3udburst -- according to precise scientific protocols and equipment specifications. Students and teachers use their measurements and observations to ground-validate satellite imagery while using Multispec (an image analysis freeware, developed by Purdue University) to further analyze LANDSAT satellite images. They also use Geographic Information Systems (GIS) software to further understand their sites. The students then send these data for archiving in a database that is freely accessible to scientists for use in their research. Students use these data for student research in collaboration with scientists, as well as for classroom studies and international school-to-school collaborations.

Derived from text

*Data Acquisition; Biological Diversity; Computer Systems Programs; Image Analysis; Satellite Imagery*

**20030016644** International Space Univ., Inc., Strasbourg, France

**Practical Remote Sensing Activities in an Interdisciplinary Masters-Level Space Course**

Farrow, J., International Space Univ., Inc., France; Becker, F., International Space Univ., Inc., France; Clandillon, S., Service Regional de Traitement d'Image et de Teledetection, France; International Conference on Remote Sensing Applications for Archeological Research and World Heritage Conservation; [2002], pp. 51-52; In English; Also announced as 20030016612; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The International Space University (ISU) encourages the creation and expansion of knowledge and the exchange and dissemination of ideas in all fields of space. The central campus is in Strasbourg, France and there is a world-wide network of faculty, alumni, sponsors, students and affiliates who share ISU's broad vision. Our programs emphasise the so-called "3Is" spirit in which interdisciplinary, international and intercultural aspects are the hallmarks of the curricula. ISU programs include the year-long Master of Space Studies (MSS) based at the campus site in Strasbourg, the two-month Summer Session Program (SSP) hosted each year at a different site around the world, research activities undertaken by faculty members, short courses and

symposia. Remote sensing is an important component in the MSS and SSP programs. This paper focuses on the MSS program in which the one-year duration affords the opportunity for students to gain some practical remote sensing experience and two well-established activities are described. First we will give some details about an assignment in which students attend a workshop on image interpretation, ground truthing and the use of GPS and then put these skills into practice in a field trip in the Vosges region close to Strasbourg. The main site for study is Mont St Odile, which has a very rich heritage from both natural and cultural perspectives and is one of the best-known tourist attractions in the area. Optical images from LANDSAT and SPOT plus radar images from ERS and Radarsat are compared with large-scale maps and ground observations. A convent whose origins date back to 700 AD is located on the summit (750 m) of Mont St. Odile from where students make comparative visual observations of the surrounding hillside, forests, a quarry and, further off, the Alsace plain. Completely surrounding the summit and stretching for over 10 km in perimeter through dense woodland are the remains of the Mur Païen (Pagan Wall). This is the largest walled enclosure in Europe and its origins and purpose remain something of a mystery to this day. Parts of the wall, 2 m thick and up to 5 m high when it was built, probably in the late Bronze Age around 1000 BC, still remain largely intact. During the field trip the students examine a section of the wall and visit the remains of one of several ancient fortresses close by. These "Chateaux Forts" date back to around 1200 AD but have stood in ruins since the late 17th. 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This paper focuses on the MSS program in which the one-year duration affords the opportunity for students to gain some practical remote sensing experience and two well-established activities are described. First we will give some details about an assignment in which students attend a workshop on image interpretation, ground truthing and the use of GPS and then put these skills into practice in a field trip in the Vosges region close to Strasbourg. The main site for study is Mont St Odile, which has a very rich heritage from both natural and cultural perspectives and is one of the best-known tourist attractions in the area. Optical images from LANDSAT and SPOT plus radar images from ERS and Radarsat are compared with large-scale maps and ground observations. 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The second project described here allows ISU's students to gain "hands-on" experience in image processing and interpretation techniques using facilities available within SERTIT (Service Regional de Traitement d'Image et de Teledetection) a remote sensing consultancy that occupies the same campus site. SERTIT's activities, described in more detail elsewhere at this conference, are of particular interest in studies of the effects of natural hazards (floods, gale damage, etc) on the regional environment. In the course of the workshop ISU's students gain familiarity with the tools and techniques used in the remote sensing sector. Some students go much deeper into this area by carrying out their 3-month long placements with SERTIT. According to feedback, the practical activities described in this paper are well appreciated by students. Clearly they help to consolidate what is taught in lectures and workshops and the basic ideas could be carried over to other courses in the space domain. Furthermore the field trip provides an early introduction for our students to the natural and cultural heritage of a very beautiful region of Alsace to which many of them return in any free time later in their year here.

Author

*Remote Sensing; Radar Imagery; Ground Truth; Image Processing*

20030016645 International Space Univ., Inc., France

**Supporting Environmental Treaties with Remote Sensing Data. An example of a MEA Application: The Kyoto Protocol**

Peter, Nicolas, International Space Univ., Inc., France; International Conference on Remote Sensing Applications for Archaeological Research and World Heritage Conservation; [2002], pp. 53-54; In English; Also announced as 20030016612; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The rapid growth in the number of multilateral environmental agreements (MEAs) treaties since the 1972 Stockholm Conference on the Environment has been an encouraging sign of international commitment to protecting the environment. The

Earth Summit in 1992 provided added impetus to the establishment of MEAs with the formation of three major conventions: the Convention on Biological Diversity (CBD), the Convention to Combat desertification (CCD) and the United Nations framework Convention on Climate Change (UNFCCC). The proliferation of treaties has resulted in an attendant need for spatial data on the health of the Earth's biophysical systems, and for better understanding of the socio-economic processes and government policies that affect the environment, This information contributes to the design of improved policy instruments. Earth Observation systems can provide reliable, factual, consistent recurrent and timely information on a global scale that may be used to map areas of interest, and can also provide measurements of certain key parameters, and monitor evolution of studied phenomena. Although the existing satellites were not designed to meet the information requirements of environmental treaties, they can be used to generate key information necessary for developing and implementing MEAs. Earth Observation systems are tools that have become essential for effectively conducting many types of environmental management and research applications. They can prompt new agreements, influence behavior under existing agreements, and evaluate past performance and effectiveness. However despite the fact that Earth Observation systems are capable of assisting the MEA process, there are a number of significant problems. These include lack of consistency and standardization of data sets and fragmented and inadequate data archives. The main purpose of this poster is to present the link between Remote Sensing in support of Multilateral Environmental Agreements, with the study of an example of a "MEA application": The Kyoto Protocol. The Kyoto & Carbon Initiative is a project launched by National Space Development Agency of Japan (NASDA) in 2001, with the aim to provide adequate data and information in support to the terrestrial carbon cycle science and international treaties, and particularly the Kyoto Protocol. It is based on the conviction that remote sensing data and specifically ALOS PALSAR and ADEOS II GLI data can play a significant role to support, partly or fully, some of the information needs by provision of systematic, consistent and repetitive high resolution data of the global land areas. The Kyoto & Carbon Initiative aims to respond to this need through the establishment of a Dedicated Data Acquisition Strategy in which spatial and temporal consistency, adequate repetition frequency, timing are taken into account as far as possible. It is duty acknowledge that Kyoto reporting requirements can not be fully met with ALOS PALSAR and ADEOS II GLI data. Kyoto relates to changes in total carbon (above ground, below ground, soil and litter), while remote sensing at best can provide info about the above-ground component. Remote Sensing is however more suitable for providing information about land cover spatial repartition and temporal dynamics.

Derived from text

*Environment Management; Remote Sensing; Data Acquisition; Carbon Cycle*

**20030016646** Graz Univ., Dept. for Communications and Wave Propagation, Austria

**Available Satellite Technology for Distributing Educational Programmes**

Birnbacher, Ulla, Graz Univ., Austria; Koudelka, Otto, Graz Univ., Austria; International Conference on Remote Sensing Applications for Archeological Research and World Heritage Conservation; [2002], pp. 55; In English; Also announced as 20030016612; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Distance education comprises many applications which differ regarding communication network requirements. Although the Internet is becoming a common platform, in various regions users do not have adequate access to the Internet and to educational information. by using geostationary satellites, users in a wide geographical area can be reached, also in areas with poor telecommunications infrastructure. Distance learning comprises two communication directions. The forward direction from the distance learning organization to the students, mainly in order to provide teaching material, and second the uplink direction, which is the communication direction from the student to a teacher / specialist for asking questions. Content distribution may include distribution of video, audio files or textual material. In order to use satellite capacity in an efficient way, a broadcast technology with economic end user equipment is suggested. Digital Video Broadcast technology over satellite (DVB-S) is proposed for the forward communication channel, because an unlimited number of users within the coverage area of the satellite can receive the information and low cost DVB receivers are available off-the-shelf. The support of multimedia is achieved by the DVB multiplexing technology, where video, audio and data streams are encoded separately and multiplexed together before transmission. The degree of interactivity determines the requirements of the return link. If no interaction is required, no return channel has to be set up. In the case of low data rates on the return channel for sending emails or requests for content, a common dial-up modem connection over a terrestrial telephone network (or over a mobile telephone or satellite telephone network) is sufficient. If high data rates have to be transmitted over the return channel, a broadband return channel (e.g. over a interactive satellite network) has to be integrated. Three different scenarios are presented and described regarding the technology of the required communication networks. Additionally, possible applications are pointed out. Scenario I describes a solution for distribution of teaching or information material. Using satellite communications, a DVB-S broadcast channel and data push-technology on the central server can be used for transmitting the information to the users. No return channel is needed. Scenario 2 enhances the distance learning applications with interaction. Teaching material located at the central server can be requested from the user and the exchange of information by email and by newsgroups is possible. to set-up the communication

network for this scenario all the equipment from scenario 1 can be reused, supplemented with return link capability at the user terminals. Common Internet access with a telephone modem dial-up connection or data connections over mobile/sat-phone networks are sufficient to send emails or to request selected information on a web page. Scenario 3 considers full interactive distance learning. Interactive lectures can be held using video conferencing, for which symmetric data rates in both communication directions are necessary, hence a broadband return channel is needed. This scenario can be realised by DVB-S broadcast on the forward link supplemented by a broadband satellite return link network. All three scenarios can be implemented in parallel using the same DVB-S forward channel, which makes the use of booked satellite capacity even more efficient. Furthermore, user terminals from one scenario can be upgraded to the other, protecting the previous financial investment. Therefore the network and the applications for a distance education programme can be implemented step by step adjusted to the needs of the users. Hence, satellite technology can be a helpful technological means, for diffusing educational programmes all over the world.

Author

*Audio Data; Broadcasting; Communication Networks; Data Flow Analysis; Digital Television; Electronic Mail; Internets; Satellite Networks*

**20030016647** Romanian Space Agency, Space Applications and Research Program, Bucharest, Romania

**The Remote Sensing Imagery: The Support of the Thematic Data Within The "Apuseni" Project**

Badea, Alexandru, Romanian Space Agency, Romania; Reif, Albert, Romanian Space Agency, Romania; Rusdea, Evelyn, Freiburg Univ., Germany; International Conference on Remote Sensing Applications for Archeological Research and World Heritage Conservation; [2002], pp. 56; In English; Also announced as 20030016612; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The specific objective of the study is to create a model of the village settlement, integrating traditional designs, modern technology, and long-term improvements in economic development resulting from the project. The project multi-disciplinary German and Romanian researchers team analyses the land tenure, local economic development, the construction of sustainable housing, and restoration of links to the natural environment to promote a sustainable lifestyle. In the same context the project will realize the integration of the information concerning the local community infrastructure facilities and services necessary for economic development and job creation purposes, including water resources, buildings, equipment, machinery, land, natural site development. At the end of the project is foreseen that the control of the rural population over natural resources will increase enhancing their capacity to discuss the policy and programmatic basis for building enduring relations between local sustainable development, environment, social and human rights, tacking into account that the members of the collectivity own the land on which it is situated in order to protect the many unique plants and animals found in the area. The forest, the main resource of the collectivity and the tourism have to be developed encouraging and rewarding the best practice : nature and ecotourism. The inventory of all those aspects is facilitated by the integration of the thematic data in a GIs. The archive aerial photos and maps at different scales together with recent satellite imagery (LANDSAT TM, SPOT and IKONOS) constitute the basic layers for the integration of the thematic data. The interim results demonstrated that a monitoring system remote sensing based offers the possibility to point out uncontrolled tendencies of the forest exploitation. It was demonstrated that the rural population of this region use the forests and other ecosystems in an unsustainable manner for their livelihood.

Author

*Remote Sensing; Aerial Photography; Economic Development; Satellite Imagery*

**20030016648** Politecnico di Milano, Dept. of Photogrammetry, Milan, Italy

**GPS and Photogrammetric Methodologies for an Archaeological Survey**

Astori, B., Politecnico di Milano, Italy; Bezoari, Giorgio, Politecnico di Milano, Italy; Guzzetti, F., Politecnico di Milano, Italy; International Conference on Remote Sensing Applications for Archeological Research and World Heritage Conservation; [2002], pp. 57; In English; Also announced as 20030016612; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The problems of survey in Ventimiglia's archaeological area are described in the report, with particular attention at the significant elements of archaeological approach, for descriptive characteristics and for metrical qualities. The list below concerns different surveys carried out: 1. topographic survey of different elements existing in the area; 2. GPS network for linking various parts of the archaeological site; 3. GPS geodetic network; 4. use of aerial photos for inserting archaeological area survey into the fabric of the city; 5. integration with close range photogrammetry. The resulting survey consist in a three dimensional database that would be used for a thematic archaeological GIs.

Author

*Global Positioning System; Aerial Photography; Archaeology; Topography; Surveys*

20030016650 Saint-Etienne Univ., France

**Mahasthan (Bangladesh), an Ancient Indian City (4th c. BC/ early 3rd c. BC): The use of SPOT Satellite Images to Study the Palaeo-Environment**

Jacqueminet, Christine, Saint-Etienne Univ., France; Gill, Sandrine, Paris III Univ., France; International Conference on Remote Sensing Applications for Archaeological Research and World Heritage Conservation; [2002], pp. 59-60; In English; Also announced as 20030016612; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Framed by a monumental brick city-wall, 1,5 km long and 1 km wide, this ancient city of Indian Empires was rediscovered in the early 19th century. Archaeological exploration of Mahasthan, started in the late 19th/early 20th century. Since 1993, a France-Bangladesh joint venture organizes annual archaeological soundings and excavation of the site, completed by environmental studies. Established on the western bank of the river Karatoya, Mahasthan, now located in North Bangladesh, was once one of more eastern urban centres of Indian Empires. Although its political connection with the Mauryan and Sunga Empires is not firmly established, the wealth of the cultural remains of Mahasthan, ancient Pundranagara, have confirmed the assumption of a monumental development of the city between the 3rd cent. BC and mid 1st cent. BC. These dates have been confirmed by a series of radiocarbon dates. Moreover, the earliest epigraphic document, an inscribed stone slab from 3rd-2nd cent. BC refers to a period of starvation when food was stored in Pundranagara. These data match perfectly the traditional picture of Mahasthan being the K capital city D of a realm extending all over the Ganges valley. The first attestation of a city wall in the restricted area of excavation dates from 2nd cent. BC/1st cent. BC. This brick wall was then reconstructed several times during the history of the city. The rather poor cultural remains of the period dated 1st cent. BC to late 2nd cent. AD suggest a movement of decline, or regional isolation.

Derived from text

*Archaeology; Bangladesh; Cities; Excavation; Satellite Imagery*

20030016651 Hiroshima Univ., Graduate School for International Development and Cooperation, Japan

**Assessing Integrity in Cultural Landscape: A Case Study from Japan**

Kamei, Mikio, Hiroshima Univ., Japan; Nakagoshi, Nobukazu, Hiroshima Univ., Japan; International Conference on Remote Sensing Applications for Archeological Research and World Heritage Conservation; [2002], pp. 61; In English; Also announced as 20030016612; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

This paper investigates the concept of integrity to assess the condition of cultural landscape. Integrity concept usually refers to a system's wholeness, including presence of all appropriate elements and occurrence of all processes at appropriate rates. Angermeier and Karr (1994) suggest a high state of biological integrity can be determined for a system that has little or no human influence. If the reference condition is pegged as an unaffected system, or even that which existed before widespread human modification, then invariably the condition of the human-modified landscape has deteriorated. However, human-modified landscape also has outstanding universal value to be conserved. For example, IUCN( 1994) has identified the following definition of a Protected Landscape/Seascape as one category of protected area: "area of land, with coast and sea as appropriate, where the interaction of people and nature over time has produced an area of distinct character with significant aesthetic, ecological and/or cultural value, and often with high biological diversity. Safeguarding the integrity of this traditional interaction is vital to the protection, maintenance and evolution of such an area". This paper attempts to make a contribution toward application of the integrity concept to cultural landscape. In addition, we discuss the potential of assessment methods through the use of Geographic Information Systems (GIS) based on findings from a case study in Japan. A framework for assessing integrity of cultural landscape is three-step process. First, the actual landscape condition compared by some reference period (historical reference) to depict landscape transformation. It seems inappropriate to use specific period as reference condition, because the conservation goal of cultural landscape is not preservation but management of change such that the qualities of the landscape are conserved for future generations. However, historical reference is supported by the recent studies that many of cultural landscape have deteriorated with development and/or abandonment in our modern era. Without understanding landscape transformation and historical developments, it is impossible to determine the appropriate context for assessing integrity. Second, several attributes or indicators are selected that adequately identifies the patterns and processes needed to conserve the entire landscape over time. They are ideally sensitive to a range of stress, relevant to societal concerns, and easy to measure and interpret. Third, integrity is interpreted through comparing between actual condition and reference condition, which is formulated by historical reference, type-specific reference, and theoretical reference. Type-specific reference is to look for existing similar type-specific conditions, i.e. sites that have best conserved their integrity. If both historical and type-specific references are missing, reference condition can also be based on theoretical models. In this paper, land cover data serves as the core information source. Integrity encompasses element composition and process performance over multiple scales. In practice, elements are used more frequently than processes as indicators of integrity because elements are typically more sensitive to degradation, more fully understood, and less expensive to monitor. However, landscape qualities cannot be judged from land cover characteristics alone. The land cover derived

cartographic products should serve as bases for further evaluation using such techniques as field surveys, cultural and historical assessments, etc.

Author

*Biological Diversity; Conservation; Degradation; Japan; Mapping*

**20030016652** Durham Univ., Dept. of Geography, UK

**Airborne Thermography of the Vegetation-Soil Interface for Detecting Shallow Ground Disturbance**

McManus, K., Durham Univ., UK; Donoghue, D., Durham Univ., UK; Brooke, C., Nottingham Univ., UK; Marsh, S., Geological Survey of Britain, UK; International Conference on Remote Sensing Applications for Archeological Research and World Heritage Conservation; [2002], pp. 62; In English; Also announced as 20030016612; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Thermal prospection techniques have application for detecting shallow ground disturbance that result from a differential heat flux in soil and vegetation canopies. Previous published research has evaluated airborne multispectral imaging for archaeological prospection and landscape assessment and results of that work have concluded that: (1) high resolution vertical aerial photography can yield excellent results, but in intensively farmed areas the crop and soil mark response is very dependent on the time of imaging, (2) near and short-wave multispectral images can help with crop mark detection and the imagery is often less seasonally constrained however these wavelengths usually only add a few details that are additional to a good aerial photograph survey; and (3) thermal infrared imagery is sensitive to emitted rather than reflected radiation and this wavelength range has been little studied in the context of shallow ground disturbance, and our own research suggests that thermal imagery significantly enhances soil marks and can detect features hidden under vegetation. This paper reviews the potential of airborne thermal prospection and then presents an investigation of measured thermal response over an archaeological target at Bosworth Field, England. The results show that the potential of thermal prospection for detecting buried structures is limited to the top 50cm layer and we investigate thermal models, including day-night thermal inertia, and report on the optimum image processing techniques for geophysical interpretation. Finally, we compare the results with magnetic and resistance surveys.

Derived from text

*Aerial Photography; Temperature Distribution; Soils; Thermography; Vegetation*

**20030016653** Air Photo Services Ltd., Cambridge, UK

**A Poor Man's Use of CORONA Images for Archaeological Survey in Armenia**

Palmer, Rog, Air Photo Services Ltd., UK; International Conference on Remote Sensing Applications for Archeological Research and World Heritage Conservation; [2002], pp. 63; In English; Also announced as 20030016612; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

To date, archaeology in Armenia has been earthbound. Most work has been excavation and most known sites are monumental. In 2000, following a request from Prof Hayk Hakobyan of the Institute of Archaeology in Yerevan, I began to help get aerial survey off the ground. One way of making this beginning was to acquire CORONA images that covered an area of about 400 square km selected for preliminary examination. KH-4B mission 1115 from 20 September 1971 was cloud-free - a rarity among the Armenian cover - and five consecutive strips of negatives were purchased. Unfortunately, the aft camera ceased functioning as soon as it reached my area so stereo cover is restricted to two overlaps. However, the negatives have the greatest resolution and clarity of any CORONA material I've seen. I have no sophisticated technology so decided to examine the images in much the same way as I would conventional vertical photographs. Prints were made on 25 x 20 cm paper where the 25cm dimension was the 6cm width of the negative. This gave about 4x magnification and high-quality prints were obtained. An advantage of doing this is that each frame can be dodged appropriately to produce an optimum print. These were scanned at 1200dpi on a Microtek X12 flatbed scanner. This resolution was decided after visual experimentation. Higher resolution gave bigger files but no appreciable difference on screen: at lower resolution some information was lost or indistinct. The resulting files were no larger than 15MB and were easy to manage without recourse to compression. The study area includes three sites that I had seen on the ground and examination of these on the images provided a key of sorts to guide me through the rest of the images. These were examined using ERViewer with each image being enlarged on screen to about 4x. Features seen - whether archaeological or not - were tabulated using the on-screen co-ordinates to provide initial locations. This list, and the indication of locations on a 1:100,000 map (the best obtainable so far), has provided a guide for field examination of a sample of the 200 'sites' identified.

Derived from text

*Computer Programs; Surveys; Cameras; Armenia; Archaeology*

**20030016654** Centre National de la Recherche Scientifique, France

**Using GIS and Remote Sensing in the Management of Protected Areas in West Africa; the example of the W. National Park**

### **in Niger**

Rabeil, T., Centre National de la Recherche Scientifique, France; Mering, C., Centre National de la Recherche Scientifique, France; International Conference on Remote Sensing Applications for Archeological Research and World Heritage Conservation; [2002], pp. 64; In English; Also announced as 20030016612; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The management and the conservation of protected areas is one of the great battle of the 21th century. The Niger W National Park has been created in 1954, and successively obtained the label of MAB Reserve and World Heritage in 1996. This protected area contains 80 % of the biodiversity of the country, particularly with northern Sudanese savanna fauna and the only remaining populations of elephant *Loxodonta africana*, buffalo *Syncerus caffer* and Kob *kobus kob*. The Park hosts the largest populations of ungulates in West Africa, and wild plant species, which are important for conservation and genetic research. Moreover, the wetland area inside the Park presents a world importance for the conservation of birds, being recognized under the Ramsar Convention. However, poaching, illegal grazing and annual migrations of Fulani cattle, uncontrolled bush fires has been occurring since the creation of the Park. GIS and Remote Sensing techniques are used in cooperation to help survey and management in the protected area. Remote Sensing can permit us the mapping of the Park land cover in order to localize suitable habitats of animals. It is also useful to find out the best sites for developments like news waterholes, tracks or survey posts. Image processing of multitemporal remote sensing data enable the monitoring of interseasonal and interannual dynamics of landscape. Consequently GIS and Remote Sensing are crucial to succeed in managing correctly all the area and to point out and measure the impact of anthropic and natural degradation of the habitats.

Derived from text

*Africa; Biological Diversity; Cattle; Birds; Conservation; Genetics; Image Processing; Mapping*

**20030016655** Rajasthan Univ., Dept. of Geology, Jaipur, India

### **Impact of Land use Changes on Rock Built Monuments-Satellite Data based Study from Western India**

Sinha, A. K., Rajasthan Univ., India; Yadav, S. P., Rajasthan Univ., India; Sharma, Anup, Rajasthan Univ., India; International Conference on Remote Sensing Applications for Archeological Research and World Heritage Conservation; [2002], pp. 65; In English; Also announced as 20030016612; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The monuments are the cultural heritage which seems to have survived for ages and are aptly termed as our prized cultural heritage which provides us a glimpse of our history. They are very important to us as well as to our posterity. The rock built monuments are impacted under all the natural environment with varying degree leading to the decay of such monuments. However they are found to decay much faster under the impact of changing and deteriorating geoenvironmental conditions. The decay of the stone is complex phenomenon The weathering and Decay of the building material of these monuments are controlled by the factors that are intrinsic of rocks such as chemistry of the rock, texture and structure, porosity etc and as well as by the influences that are external such as geoenvironmental set up which includes ambient air quality, Temperature, rainfall, land use/land- cover pattern, lithology, and the geomorphological setting around the monuments. The objective has been to understand the causes of the decay of some of the historically, archeologically and culturally relevant monument of western India belonging to the medieval period, The present paper deals with case studies from western India where in Satellite data (IRS Ib LISS II FCC on scale 1: 50000) was used to prepare landuse and land cover map to understand the geoenvironmental impact on the decay process of the monuments. One of the temple complex has been found to have undergone significant abrasion due to the impact of the sand laden wind. Stabilised sand dune region turned into mobile sand dune zone after the changes in land use condition. The paper suggests the conservation measures on the basis of finding of the study.

Author

*Air Quality; Conservation; Deterioration; Geomorphology; India; Land Use; Rocks; Structural Properties (Geology)*

**20030016656** Foundation for Research and Technology-Hellas, Iraklion, Inst. of Mediterranean Studies, Crete, Greece

### **Defining the Minoan Cultural Landscape by the use of GIS**

Soetens, Steven, Foundation for Research and Technology-Hellas, Iraklion, Greece; Topouzi, S., Foundation for Research and Technology-Hellas, Iraklion, Greece; Sarris, A., Foundation for Research and Technology-Hellas, Iraklion, Greece; International Conference on Remote Sensing Applications for Archeological Research and World Heritage Conservation; [2002], pp. 66; In English; Also announced as 20030016612; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Minoan peak sanctuaries are located all over the mountain peaks of Crete and cover a period from +/- 2300 BC to +/- 1500 BC. They are not very attractive for tourism, due to abrupt slopes, high elevations, and they often lack any architectural relics. Their remote location is also reflected in the poor record of intensive excavation activities. Antenna constructions, church building

and illegal digging highly threaten the preservation of these sites. Their archaeological importance however is significant. As indicated by previous research, a strong relation existed between the Minoan palaces and these sanctuaries, which is reflected in the occasional rich artifact assemblage. It was also suggested that they played a critical role in the Minoan topography of power. This project started with the recording of the exact topographical location of about 70 threatened mountain sites by high accuracy DGPS, as well as the location of many other important Minoan sites within the same projection system. GIS approach has further enhanced the sanctuaries' importance within the Minoan cultural landscape as well as the importance of the landscape itself, it has proposed new interpretations to the function and meaning of the sites, and it provides a means to predict most probable locations for unknown sites. So far all peak sanctuaries as well as other relevant sites of the same periods were visited and coordinates were taken by DGPS (Differential Global Positioning System). The whole of Crete's topography, hydrology, geology, land use and land capability have been digitized on scale 1/50000. All these layers were georeferenced to a common projection system (EGSA87) together with a SPOT Stereoscopic Satellite Image, and its main derivative, a DEM with 50m pixel resolution. Archaeological data and panoramic photographs have been collected and registered to an Access database, and can be queried straight in ArcView through an SQL connection. The presentation and analysis of the layers was done by use of a variety of GIS programs, depending on their accuracy and usefulness (AutoCAD2000, TNTmips, ArcView 3.2). The analyses of these information layers, combined with the archaeological data allow us to better understand the Minoan cultural landscape and the peak sanctuaries. The main techniques are spatial (viewsheds, nearest feature, cost surface) and multivariate analyses. The present paper will show how the complex integration of archaeological, environmental and spatial data in a GIS environment and the analysis of these data can enlighten the meaning and function of the peak sanctuary and put in focus the cultural qualities of the Cretan landscape.

Author

*Archaeology; Assemblies; Construction; Data Bases; Excavation; Geology; Multivariate Statistical Analysis*

**20030016657** National Office of Cultural Heritage, Dept. for Documentation, Budapest, Hungary

**Underwater Archaeological Heritage of Hungary Working on the Topography**

Toth, Attila J., National Office of Cultural Heritage, Hungary; International Conference on Remote Sensing Applications for Archeological Research and World Heritage Conservation; [2002], pp. 67; In English; Also announced as 20030016612; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

In 2002 the Scientific Directorate of the National Office of Cultural Heritage has started a project for the protection of underwater archaeological heritage. The first step is making an archaeological database, localising, determining the elements of underwater cultural heritage and working out the methods of survey. It fits well in the documentary strategy of the Office, which concentrates on a database of the cultural heritage, which is connected with GIS. The problem is, that our sites situate in inland fish-waters (lakes and rivers), where the visibility is reduced to quasi zero, the streams are strong. The traditional sources of information are the materials from dredging, informations from divers, archival and literary sources, ancient maps. These informations are often inaccurate or limited. Our purpose was to complete the traditional sources with remote sensing methods: aerial photography and satellite images. There are successful examples from marine environments, but there were not experiments in the fresh waters of Hungary. We would like to illustrate our research through two examples. The first case is the lake Balaton with submerged island, portual construction and filled up bays. These are detected on ancient maps, aerial photographs, and in some cases satellite images and reinforced by field survey. The second example is a river site, in the bed of a Danube branch. Here the problem was the relation of underwater archaeological remains (wall) and a terrestrial site (a roman watch tower, burgus). by the use of GPS and laser teodolit it was possible to define the relation of the two feature, separated by ca. 2m elevation, and vivid riverside vegetation. In the protection of the underwater sites is important the communication and cooperation with the data bases of the national parks and the water conservancy offices. The rivers of Hungary are traditional communication lines and commercial routes of Central Europe, the underwater heritage of these waters are important elements of the European past. We are open to international cooperation.

Author

*Aerial Photography; Archaeology; Data Bases; Hungary; Lakes; Marine Environments; Protection; Topography*

**20030016658** Indian Space Research Organization, Regional Remote Sensing Service Centre, Jodhpur, India

**Discovering Course of the Palaeo River "Sarasvati" from Satellite Data and its Correlation with Archaeological, Hydrogeological and Drilling Data**

Gupta, A. K., Indian Space Research Organization, India; Sharma, J. R., Indian Space Research Organization, India; International Conference on Remote Sensing Applications for Archeological Research and World Heritage Conservation; [2002], pp. 68; In English; Also announced as 20030016612; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

River Sarasvati, the mightiest river of the Vedic Period (10,000 - 8,000 BP), is vividly described in the Rigveda (oldest ancient Indian literature) as the "Ambitame - Naditame - Devitame" that is the best of mothers, best of rivers and the best of goddess, indicating magnanimity of the river during that period. The mention of the river is also found in subsequent ancient Indian literature viz. Brahmana and SRautasutra literature, Bhagvat Purana, Vamana Purana, Ramayana, Mahabharata, and Upnishads etc. The river was holy and religiously adored, with seats of learning and Ashramas (Hermitages) of many Rishis (Saints) like YAGyavalka, Dadhichi, Parasurama etc., located along the banks of the river. The river became extinct during 4000 - 3500 BP due to tectonic and palaeo climatic changes in the region. The Harappan civilization thrived mainly along the course of Sarasvati as confirmed from the occurrence of a large number of archaeological sites discovered along Sarasvati course and near absence of the Harappan sites along the present day major rivers like Ganges and Indus located in this region. A number of studies have been carried out by the researchers during last 25 years using remote sensing data to trace the course of palaeo river Sarasvati and map palaeo drainage courses. Most of these mapped courses have been linked to the different courses of extinct river Sarasvati and its tributaries. Varying number of courses of river Sarasvati have been suggested by the different workers. During last 20 years there have been significant improvements in fields of satellite and sensor technologies as well as in digital processing of satellite data. A need is therefore felt to re-establish the courses of river Sarasvati, through use of latest available digital remote sensing data and solve the controversy about the actual course(s) of the river. A study is therefore carried out for mapping of the palaeo drainage network in the north- western region using digital data from IRS WiFS, LISS-I, LISS-III and PAN sensors. The study area comprise of the region, covering NW part of Rajasthan and Kachchh region of Gujrat states, apart from adjoining area in the Pakistan across the International Border (IB). The map prepared indicates five prominent NE-SW trending palaeo drainage courses, out of which the first two courses pass closer to Aravalli Hills, while last two courses closer to IB with Pakistan. Out of these, the last two courses emerging from Ghaggar and passing further down through Jaisalmer district and further inside Pakistan territory (along IB) and finally meeting Rann of Kachchh are quite prominent (4-10 km broad) and conform to the magnanimity and description of river Sarasvati in the Rig Vedic literature. Data available from a variety of ground investigations carried out by different agencies working in this area have been analyzed in support of confirmation of Sarasvati palaeo channels, along the courses mapped under the present study. Litholog data from drillings along palaeo channels by the Ground Water Department-Government of Rajasthan, data from archaeological finds in the region, age and quality of ground water, geomorphic image anomalies etc., together indicate that the river Sarasvati drained closer to the present day IB. It passed through river Ghaggar and did not drain along the Aravalli hills. Also it did not shift its courses drastically and continuously from east to west, as suggested by some of the earlier workers. The image anomalies clearly indicate that river Sarasvati flowed parallel to the river Indus as an independent river system and did not flow through present day course of river Nara. The findings raise the doubt that "Rise along Delhi-Hardwar ridge" as suggested by Bakliwal and Grover (1988) and supported by Valdiya (1996, 2002) was the main cause for west ward shift of Sarasvati river and ultimate drainage desiccation in the NW Indian and adjoining Pakistan region. The analysis indicate towards rise in Himalyas/ Siwaliks and consequent displacements in the Siwaliks and its foot Hills region in the form of Yamuna and Satlej tear faults as the main cause for drainage desiccation and disappearance of river Sarasvati. The results of the study are presented in the paper.

Author

*Anomalies; Archaeology; Digital Data; Drainage; Exploration; Ground Water; Rivers*

**20030016659** Foundation for Research and Technology-Hellas, Iraklion, Inst. for Mediterranean Studies, Crete, Greece

**Space Technologies in Archaeological Research and CRM of Semi-Arid and Desertification Affected Regions. Examples from China and Greece**

Sarris, Apostolos, Foundation for Research and Technology-Hellas, Iraklion, Greece; Topouzi, Sofia, Foundation for Research and Technology-Hellas, Iraklion, Greece; Chatziordanou, Eleni, Technical Univ. of Crete, Greece; Liu, Jianguo, Center for Archaeological Science and Technology, China; Xu, Lianggao, Center for Archaeological Science and Technology, China; International Conference on Remote Sensing Applications for Archeological Research and World Heritage Conservation; [2002], pp. 70; In English; Also announced as 20030016612; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Geographical Information Systems and Remote Sensing techniques were used as detection and monitoring means in the archaeological research and cultural resources management in semi-dry and desertification affected regions. Two pilot study areas were chosen, Lasithi in Greece and Zhouyuan in China, in order to take in account the diverse nature of monuments and sites (with respect to the area coverage, building materials, conservation status, etc), and the environmental setting of the surrounding regions.

Derived from text

*Archaeology; Arid Lands; Conservation; Geographic Information Systems; Greece; Resources Management*

**20030016660** Technische Hochschule, Aachen Univ. of Technology, Aachen, Germany

**Development and Implementation of an Internet Web Map Server for World Heritage Sites**

Leppig, B., Technische Hochschule, Germany; Paulowitz, Bernd, United Nations Educational, Scientific and Cultural Organization, France; Hernandez, Mario, United Nations Educational, Scientific and Cultural Organization, France; International Conference on Remote Sensing Applications for Archeological Research and World Heritage Conservation; [2002], pp. 71; In English; Also announced as 20030016612; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The World Heritage Convention came into effect in 1972. Since then UNESCO, and later on the UNESCO's World Heritage Centre, are collecting data and information with respect to sites to be proposed as World Heritage sites. Associated with the information for each site, there should be the corresponding cartography indicating the boundaries of the site as well as the protected area (buffer zone). However, site cartography is in many cases missing or inaccurate. During the last three years the World Heritage Centre has been dedicating special emphasis to collect, from countries signatories of the Convention, the necessary cartography. In close coordination with the University of Ghent an Internet map server is being developed. In order to be able to identify the precise requirements and technical specifications for such a map server, an operational map server has been developed by the World Heritage Centre. The system is built on 'open source' web-mapping software. Its objective is to be an Internet portal to visualize GIS-Layers (Geographical Information Systems). The main layers under consideration are the site boundaries plus a series of basic layers to better assist the user identifying the geographical area: main water bodies, international boundaries, administrative boundaries, main roads and towns. Internet users can either visualize the previously mentioned layers using a simple web-browser, and/or unload selected layers to their own computer for further integration into a more sophisticated GIS system. All this GIS data manipulation is possible only if all users make use of "open-GIS standards". The system will be demonstrated at the poster session. A client can freely navigate and query World Heritage site maps in different levels of detail. In addition basic layers can also be displayed. The system is based on a global-, national-, sub-national- and site-level approach, where each time the level of information is strengthened by additional layers of information. This experience has been successful for the definition of the main requirements for such a map-server. As with all GIS applications, this experience has significantly assisted in order to implement common standards for all data layers. This approach will significantly assist States Parties of the World Heritage Convention in understanding, through the visualization of operational examples, the type of cartographic information required. The poster session will demonstrate an on-line connection to the system described herein.

Derived from text

*Coordination; Geographic Information Systems; Data Acquisition; Internets; Mapping*

**20030016661** Bordeaux Univ., France

**New Airborne SAR for a New Method of Archaeological Prospection of Buried Remains**

Chapoulie, Remy, Bordeaux Univ., France; Martinaud, Michel, Bordeaux 1 Univ., France; Paillou, Philippe, Observatoire de Bordeaux, France; Dreuillet, Philippe, Office National d'Etudes et de Recherches Aérospatiales, France; International Conference on Remote Sensing Applications for Archaeological Research and World Heritage Conservation; [2002], pp. 72; In English; Also announced as 20030016612; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The airborne P-band Synthetic Aperture Radar (SAR) called RAMSES, operated by ONERA, can be used for the detection of buried features thanks to its low central frequency (435 MHz). This system will enable fast archaeological prospecting of very large surfaces. This is a new potential application using this new high-resolution space-borne SAR for the preservation and the study of buried cultural heritage.

Author

*Synthetic Aperture Radar; Archaeology; P Band; Exploration*

**20030016662** Tehran Univ., Dept. of Archaeology, Tehran, Iran (Islamic Republic of)

**Landscape Archaeological Heritage Management in the Information Age Prospects for the Future Development of GIS in Iran**

Niknami, Kamal Aldin, Tehran Univ., Iran (Islamic Republic of); International Conference on Remote Sensing Applications for Archeological Research and World Heritage Conservation; [2002], pp. 74; In English; Also announced as 20030016612; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The advances which, have been made in the last few years in the methods of inventorying and documentation of archaeological sites, have taken place mainly due to advances in computer technology, This dynamically developing has supplied applications of a universal character, and thus of use to the archaeological profession, and especially the heritage management services. The appearance of a new operation system, Microsoft Windows based on a graphic environment, has allowed the linking

graphic data in the database. This allows the enriching of the information in the archaeological database with drawing of artifacts photograph, etc. After the increasing widespread use of the new category of computer programs, defined by the term GIS, further development became possible which, relied on the creation with the aid of the computer of digital maps (the electronic equivalent of geographic and topographic maps). The archaeologists are using now the various types of cartographic material. The perspective is opened of the creation of specialist archaeological maps with the aid of the computer. In order to apply these innovations it is necessary to supplement the database on archaeological sites with information concerning the situation of the sites in the form of cartographic information. The fulfilling of this condition opens new perspectives in the use of the computer for archaeological conservation purposes including the possibility of the realization of a series of routine activities of the archaeological conservator. The GIS technology has not been applied in Iran (until recently with the present project) on a wider scale as a method of discovering and documenting archaeological sites. The scope of information on archaeological sites collected so far seems, to be insufficient to formulate a correct decision. When a powerful tool known as GIS becomes available, it becomes possible to integrate the products of this method with results of surface survey and geophysical examinations on the background of topographical map.

Author

*Archaeology; Computer Programs; Surveys; Relief Maps; Management Information Systems; Data Bases*

**20030016718** Geological Survey, Water Resources Div., Northborough, MA USA

**Measured and Simulated Runoff to the Lower Charles River, Massachusetts, October 1999-September 2000**

Zarriello, P. J.; Barlow, L. K.; 2002; In English; This document is color dependent and/or in landscape layout. It is currently only available on CD-ROM

Report No.(s): PB2003-101729; USGS-WRI-024129; No Copyright; Avail: National Technical Information Service (NTIS)

This report describes the five Storm Water Management Models (SWMM) developed to simulate runoff to the lower Charles River, Massachusetts. The modeling effort described supports a companion study conducted by the USGS to calculate non-CSO contaminant loads to the lower Charles River. Runoff models were used to: (1) simulate discharge at ungaged sites during the 2000 water year, (2) simulate discharge at gaged sites where data are missing or suspect during the 2000 water year, (3) simulate discharge at all outfalls for the July 15-18 and the July 26-31, 2000 storms for the MWRA and (4) simulate discharge at all outfalls for two design storms.

NTIS

*Simulation; Measure and Integration; Drainage; Disposal; Surface Water*

**20030016719** Geological Survey, Water Resources Div., Nashville, TN USA

**Hydrogeology and Ground-Water-Flow Simulation of the Cave Springs Area, Hixson, Tennessee**

Haugh, C. J.; 2002; In English; This document is color dependent and/or in landscape layout. It is currently only available on CD-ROM

Report No.(s): PB2003-101728; USGS-WRI-02-4091; No Copyright; Avail: National Technical Information Service (NTIS)

This report presents results of an investigation of the Cave Springs area ground-water system. The report includes a general description of the hydrogeology of the study area, an estimated annual water budget for the study area, and an analysis of the effects of pumping at the Walkers Corner well field on the local ground-water system. This report also presents potentiometric-surface maps of the aquifer under conditions of pre- and post-pumping at Walkers Corner and simulation results of ground-water-flow modeling of the ground-water system.

NTIS

*Hydrogeology; Ground Water; Water Flow; Tennessee; Rivers; Water Management*

**20030016720** Geological Survey, Water Resources Div., Urbana, IL USA

**Delineation of the Troy Bedrock Vally and Particle-Tracking Analysis of Ground-Water Flow Underlying Belvidere, Illinois**

Mills, P. C.; Halford, K. J.; Cobb, R. P.; 2002; 3p; In English; This document is color dependent and/or in landscape layout. It is currently only available on CD-ROM

Report No.(s): PB2003-101727; USGS-WRI-02-4062; No Copyright; Avail: National Technical Information Service (NTIS)

This report presents and interprets water-chemistry data collected primarily during December 2000, briefly describes the previously developed ground-water flow model, and presents results of particle-tracking analysis. Water-chemistry data primarily include tritium, field-determined characteristics, major ions, and VOC's; selected trace element, radon, and radium data also are included. Interpretations of water-chemistry data are limited to those data associated with the study objectives of delineating the

hydrostratigraphy and water quality of the Troy Bedrock Valley. These data are examined with respect to geologic information from available well-construction logs.

NTIS

*Ground Water; Water Flow; Chemical Analysis; Trace Elements; Hydrology Models*

**20030017750** Geological Survey, Water Resources Div., Tacoma, WA USA

**Simulation of the Ground-Water Flow System at Naval Submarine Base Bangor and Vicinity, Kitsap County, Washington**  
vanHeeswijk, M.; Smith, D. T.; 2002; In English; This document is color dependent and/or in landscape layout. It is currently only available on CD-ROM

Report No.(s): PB2003-102490; USGS/WRI-02-4261; No Copyright; Avail: National Technical Information Service (NTIS)

The purpose of this report is to evaluate how ground-water flow on SUBASE Bangor interacts with the regional ground-water flow system and how four hypothetical alternatives of future ground-water pumping potentially affect the ground-water flow system. The study examines the effects of projected ground-water pumping on: (1) locations of zones of recharge of hypothetical pumping wells southwest of the base and public-supply wells on-base and off-base, (2) traveltimes of advectively transported, imaginary particles from a ground-water contaminant plume on-base to specific public supply wells off-base, and (4) potential saltwater encroachment. Four hypothetical alternatives of projected ground-water pumping rates were considered.

NTIS

*Ground Water; Aquifers; Simulation; Fluid Flow*

**20030017768** Geological Survey, Water Resources Div., Albuquerque, NM USA

**Spatial and Temporal Variations in Streamflow, Dissolved Solids, Nutrients, and Suspended Sediment in the Rio Grande Valley Study Unit, Colorado, New Mexico, and Texas, 1993-95: National Water Quality Assessment Program**

Moore, S. J.; Anderholm, S. K.; 2002; In English; This document is color dependent and/or in landscape layout. It is currently only available on CD-ROM

Report No.(s): PB2003-102492; USGS/WRI-02-4224; No Copyright; Avail: National Technical Information Service (NTIS)

This report describes the spatial and temporal variations in streamflow and water quality in the Rio Grande from Del Norte, Colorado, to El Paso, Texas. The variations in water as it moves downstream reflect the volume and composition of inflows to or outflows from the Rio Grande. Many times the variations are small in terms of actual concentration but large in terms of percent difference between two sites; nevertheless, determining the effects of inflows and outflows on streamflow and water quality is useful in evaluating the impact of natural and anthropogenic factors on the Rio Grande. Selected water-quality constituents described in this report are dissolved solids, dissolved nitrite plus nitrate as nitrogen, total phosphorus, and suspended sediment.

NTIS

*Solids; Water Quality; Sediments; Temporal Distribution; Spatial Distribution; Dissolving; Caloric Requirements; Laminar Flow*

**20030017986** Colorado Univ., Boulder, CO USA

**Application of Satellite SAR Imagery in Mapping the Active Layer of Arctic Permafrost Final Report**

Zhang, Ting-Jun, Colorado Univ., USA; Li, Shu-Sun, Alaska Univ., USA; [2003]; 4p; In English

Contract(s)/Grant(s): NAG5-8615; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The objective of this project is to map the spatial variation of the active layer over the arctic permafrost in terms of two parameters: (i) timing and duration of thaw period and (ii) differential frost heave and thaw settlement of the active layer. to achieve this goal, remote sensing, numerical modeling, and related field measurements are required. Tasks for the University of Colorado team are to: (i) determine the timing of snow disappearance in spring through changes in surface albedo (ii) simulate the freezing and thawing processes of the active layer and (iii) simulate the impact of snow cover on permafrost presence.

Derived from text

*Arctic Regions; Mathematical Models; Permafrost; Synthetic Aperture Radar; Remote Sensing*

**20030017990** Instituto Nacional de Pesquisas Espaciais, Sao Jose dos Campos, Brazil

**Elaboration of Vegetation Maps for Utilization in Meteorological and Hydrological Models *Elaboracao de Mapas de Vegetacao para Utilizacao em modelos Meteorologicos e Hidrologicos***

Sestini, Marcelo Francisco, Conselho Nacional de Pesquisas, Brazil; CeliadosSantosAlvala, Regina, Instituto Nacional de Pesquisas Espaciais, Brazil; Mello, Eliana Maria Kalil, Instituto Nacional de Pesquisas Espaciais, Brazil; deMorissonValeriano, Dalton, Instituto Nacional de Pesquisas Espaciais, Brazil; Chan, Chou Sin, Instituto Nacional de Pesquisas Espaciais, Brazil; Nobre, Carlos Afonso, Instituto Nacional de Pesquisas Espaciais, Brazil; ArgemirodeCarvalhoPaiva, Joao, Instituto Nacional de

Pesquisas Espaciais, Brazil; daSilvaReimer, Erica, Conselho Nacional de Pesquisas, Brazil; 2002; 86p; In Portuguese; Original contains color illustrations

Report No.(s): INPE-8972-RPQ/730; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

The objective of this project is to improve the surface representation shield utilized by weather and climate forecasting models as well as hydrological models. For that purpose, information from the RADAM-IBGE digital maps (scales 1:1.000.000 and 1:5.000.000), deforestation information from the Amazonia Program (monitoring of the Legal Amazonia deforestation - PRODES) of the OBT/INPE and high resolution space images were utilized. A methodology was developed to obtain an accurate and detailed representation of the surface, adapted to the types of vegetation examined on the models. Through the TM LANDSAT segmentation and classification of images, the separation of biomes was obtained which was incorporated on the IBGE map. The IBGE map was then reclassified in accordance with a previously defined compatibility between the RADAM-IBGE types and the ones utilized by the SsiB surface model. The PRODES data were then integrated into this map. The final product is a map that, compared to the one actually used in CPTEC, has shown a more realistic surface representation, which will allow an improvement in the forecasting of weather and climate.

Author

*Hydrology Models; Maps; Vegetation; Meteorology; Climatology; Weather Forecasting*

## 44

### ENERGY PRODUCTION AND CONVERSION

*Includes specific energy conversion systems, e.g., fuel cells; and solar, geothermal, windpower, and waterwave conversion systems; energy storage; and traditional power generators. For technologies related to nuclear energy production see 73 Nuclear Physics. For related information see also 07 Aircraft Propulsion and Power; 20 Spacecraft Propulsion and Power, and 28 Propellants and Fuels.*

**20030015744** Lawrence Livermore National Lab., Livermore, CA USA

#### **Carbonless Transportation and Energy Storage in Future Energy Systems**

Berry, G. D.; Lamont, A. D.; Jan. 17, 2001; In English; This document is color dependent and/or in landscape layout. It is currently available on CD-ROM

Report No.(s): DE2002-792733; UCRL-ID-142084; No Copyright; Avail: National Technical Information Service (NTIS)

Electricity is the highest quality energy carrier, increasingly dominant throughout the world's energy infrastructure. Ultimately electricity use can expand to efficiently meet virtually all stationary energy applications, eliminating stationary end-use carbon emissions. This approach is unlikely to work in transportation, however, due to the high cost and low energy density of electricity storage. Chemical energy carriers, such as hydrogen, can more effectively serve transportation fuel and energy storage applications, offering much higher energy density at lower cost. Electrolytic hydrogen, extracted from steam with renewable energy, stored as a high pressure gas or cryogenic liquid, and reconverted to electricity in fuel cells and or used to power hydrogen vehicles, will reduce emissions from both transportation and electric generation. Renewable resources and modular electrolytic technology also permit decentralized hydrogen production, circumventing distribution issues and barriers to market entry. In contrast, sequestration-based fossil-fueled systems must achieve economies of scale by relying on centralized production and hierarchical transmission and distribution of electricity, hydrogen fuel, and carbon (dioxide).

NTIS

*Carbon Dioxide; Transportation Energy; Electric Generators; Hydrogen Fuels; Cryogenics*

**20030015745** Lawrence Livermore National Lab., Livermore, CA USA

#### **Design of Storage Systems Using Multiple Storage Technologies in Renewable Systems**

Lamont, A.; Jan. 17, 2001; In English; This document is color dependent and/or in landscape layout. It is currently available on CD-ROM

Report No.(s): DE2002-792735; UCRL-ID-142083; No Copyright; Avail: National Technical Information Service (NTIS)

Energy systems that rely on intermittent renewable sources typically use storage devices to improve their reliability. Large scale systems can be expected to cycle the storage capacity on cycles ranging from a day to a year. It can be cost effective to use several storage technologies as a system. A very efficient technology can be used for the smaller daily cycles even if it has a high capital cost. Conversely, a technology having a low efficiency but a low capital cost can be used for the larger longer period cycles. This paper presents a method for determining the optimal capacities for a set of storage technologies. It is analogous to techniques

used in electric generation capacity planning that use a load duration curve along with the capital and operating costs of various generations technologies.

NTIS

*Energy Storage; Electric Generators; Renewable Energy*

**20030015746** Lawrence Livermore National Lab., Livermore, CA USA

**Modeling Renewable Penetration Using a Network Economic Model**

Lamont, A.; Mar. 06, 2001; In English; This document is color dependent and/or in landscape layout. It is currently available on CD-ROM

Report No.(s): DE2002-792736; UCRL-ID-142082; No Copyright; Avail: National Technical Information Service (NTIS)

This paper evaluates the accuracy of a network economic modeling approach in designing energy systems having renewable and conventional generators. The network approach models the system as a network of processes such as demands, generators, markets, and resources. The model reaches a solution by exchanging prices and quantity information between the nodes of the system. This formulation is very flexible and takes very little time to build and modify models. This paper reports an experiment designing a system with photovoltaic and base and peak fossil generators. The level of PV penetration as a function of its price and the capacities of the fossil generators were determined using the network approach and using an exact, analytic approach. It is found that the two methods agree very closely in terms of the optimal capacities and are nearly identical in terms of annual system costs.

NTIS

*Renewable Energy; Penetration; Fossils*

**20030015747** Wisconsin Univ., Madison, WI USA

**Nuclear Microbattery for MEMS Devices Final Report**

Blanchard, J.; Henderson, D.; Lal, A.; 2002; In English

Report No.(s): DE2002-799209; No Copyright; Avail: National Technical Information Service (NTIS)

This project was designed to demonstrate the feasibility of producing on-board power for MEMS devices using radioisotopes. MEMS is a fast growing field, with hopes for producing a wide variety of revolutionary applications, including 'labs on a chip,' micromachined scanning tunneling microscopes, microscopic detectors for biological agents, microsystems for DNA identification, etc. Currently, these applications are limited by the lack of an on-board power source. Research is ongoing to study approaches such as fuel cells, fossil fuels, and chemical batteries, but all these concepts have limitations. For long-lived, high energy density applications, on-board radioisotope power offers the best choice.

NTIS

*Electric Batteries; Radioactive Isotopes; Fossil Fuels*

**20030015809** Energy Information Administration, Office of Integrated Analysis and Forecasting, Washington, DC USA

**Emissions of Greenhouse Gases in the USA 2001**

Dec. 2002; 122p; In English

Report No.(s): PB2003-102445; DOE/EIA-0573(2001); No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

U.S. emissions of greenhouse gases in 2001 totaled 1,883 million metric tons carbon equivalent, 1.2 percent less than in 2000 (1,907 million metric tons carbon equivalent). The 1.2-percent decrease from 2000 to 2001 is the largest percentage annual decline in total U.S. greenhouse gas emissions during the 1990 to 2001 time frame. The only other year since 1990 in which total emissions have declined is 1991, when emissions fell by 0.6 percent. U.S. greenhouse gas emissions have averaged 1.0-percent annual growth since 1990. The decline in U.S. greenhouse gas emissions can be attributed to the combination of the following factors: a reduction in overall economic growth from 3.8 percent in 2000 to 0.3 percent in 2001; a 4.4-percent reduction in manufacturing output that lowered industrial emissions; warmer winter weather that decreased the demand for heating fuels; and a drop in electricity demand and coal-fired power generation that reduced emissions from electricity generation.

NTIS

*Exhaust Emission; Exhaust Gases; Carbon*

**20030016569** NASA Glenn Research Center, Cleveland, OH USA

**Thin-Film Organic-Based Solar Cells for Space Power**

Bailey, Sheila G., NASA Glenn Research Center, USA; Harris, Jerry D., NASA Glenn Research Center, USA; Hepp, Aloysius F., NASA Glenn Research Center, USA; Anglin, Emily J., NASA Glenn Research Center, USA; Raffaele, Ryne P., NASA Glenn Research Center, USA; Clark, Harry R., Jr., Townsend Science and Engineering, USA; Gardner, Susan T. P., Physical Sciences,

Inc., USA; Sun, Sam S., Norfolk State Univ., USA; [2001]; 6p; In English; CD-ROM contains full text document in PDF format Report No.(s): NONP-NASA-CD-2002153509; No Copyright; Avail: CASI; C01, CD-ROM; A02, Hardcopy; A01, Microfiche

Recent advances in dye-sensitized and organic polymer solar cells have lead NASA to investigate the potential of these devices for space power generation. Dye-sensitized solar cells were exposed to simulated low-earth orbit conditions and their performance evaluated. All cells were characterized under simulated air mass zero (AM0) illumination. Complete cells were exposed to pressures less than  $1 \times 10^{-7}$  torr for over a month, with no sign of sealant failure or electrolyte leakage. Cells from Solaronix SA were rapid thermal cycled under simulated low-earth orbit conditions. The cells were cycled 100 times from -80 C to 80 C, which is equivalent to 6 days in orbit. The best cell had a 4.6% loss in efficiency as a result of the thermal cycling. In a separate project, novel -Bridge-Donor-Bridge-Acceptor- (-BDBA-) type conjugated block copolymer systems have been synthesized and characterized by photoluminescence (PL). In comparison to pristine donor or acceptor, the PL emissions of final -B-D-B-A- block copolymer films were quenched over 99%. Effective and efficient photo induced electron transfer and charge separation occurs due to the interfaces of micro phase separated donor and acceptor blocks. The system is very promising for a variety high efficiency light harvesting applications. Under an SBIR contract, fullerene-doped polymer-based photovoltaic devices were fabricated and characterized. The best devices showed overall power efficiencies of approximately 0.14% under white light. Devices fabricated from 2% solids content solutions in chlorobenzene gave the best results. Presently, device lifetimes are too short to be practical for space applications.

Author

*Block Copolymers; Photoluminescence; Solar Cells; Thin Films; Fabrication; Aerospace Systems; Power Efficiency*

**20030016686** NASA Glenn Research Center, Cleveland, OH USA

**DC Bus Regulation With a Flywheel Energy Storage System**

Kenny, Barbara H., NASA Glenn Research Center, USA; Kascak, Peter E., Toledo Univ., USA; January 2003; 16p; In English; Power Systems Conference, 29-31 Oct. 2002, Coral Springs, FL, USA; Sponsored by Society of Automotive Engineers, Inc., USA; Original contains color illustrations

Contract(s)/Grant(s): RTOP 755-12-10

Report No.(s): NASA/TM-2002-211897/REV1; NAS 1.15:211897/REV1; E-13579-1/REV1; Rept-02PSC-61/REV1; Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche; Distribution as joint owner in the copyright; Distribution as joint owner in the copyright

This paper describes the DC bus regulation control algorithm for the NASA flywheel energy storage system during charge, charge reduction and discharge modes of operation. The algorithm was experimentally verified with results given in a previous paper. This paper presents the necessary models for simulation with detailed block diagrams of the controller algorithm. It is shown that the flywheel system and the controller can be modeled in three levels of detail depending on the type of analysis required. The three models are explained and then compared using simulation results.

Author

*Algorithms; Controllers; Flywheels; Electric Energy Storage; Electric Motors; Systems Simulation*

**20030017996** Texas Univ., Dept. of Electrical and Computer Engineering, El Paso, TX USA

**Thin-film Solar Cells for Space Applications Final Report, Jul. 1999 - Sep. 2002**

Lush, Gregory B., Texas Univ., USA; Jan. 31, 2003; 42p; In English

Contract(s)/Grant(s): NAG3-2303; BMDO-21620379

Report No.(s): NRA-99-OEOP-4; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The proposed work supports MURED goals by fostering research and development activities at Fisk and UTEP which contribute substantially to NASA's mission, preparing faculty and students at Fisk and UTEP to successfully participate in the conventional, competitive research and education process, and increasing the number of students to successfully complete degrees in NASA related fields. The project also addresses directly a core need of NASA for space power and is consistent with the Core Responsibilities of the John Glenn Space Center. Current orbital missions are limited by radiation from high energy particles trapped in the Van Allen Belt because that solar radiation degrades cell performance by damaging the crystalline lattice. Some potential orbits have been inaccessible because the radiation is too severe. Thin-film solar cells, if they can be adapted for use in the unfriendly space environment, could open new orbits to satellites by providing a radiation hard source of power. The manned mission to Mars requires photovoltaic devices for both the trip there and as a power supply on the surface. Solar arrays using thin films offer a low power/weight ratio solution that provides reliable photovoltaic power.

Derived from text

*Thin Films; Solar Cells; Aerospace Environments; Particle Energy; Radiation Sources; Solar Radiation; Solar Arrays*

45  
**ENVIRONMENT POLLUTION**

*Includes atmospheric, water, soil, noise, and thermal pollution.*

**20030014739** NASA Goddard Inst. for Space Studies, New York, NY USA

**Information Theoretic Approaches to Rapid Discovery of Relationships in Large Climate Data Sets**

Knuth, Kevin H., NASA Ames Research Center, USA; Rossow, William B., NASA Goddard Inst. for Space Studies, USA; [2002]; 2p; In English; American Geophysical Union, 6-10 Dec. 2002, San Francisco, CA, USA; Sponsored by American Geophysical Union, USA

Report No.(s): B61A-0703; Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Distribution as joint owner in the copyright; Distribution as joint owner in the copyright

Mutual information as the asymptotic Bayesian measure of independence is an excellent starting point for investigating the existence of possible relationships among climate-relevant variables in large data sets. As mutual information is a nonlinear function of its arguments, it is not beholden to the assumption of a linear relationship between the variables in question and can reveal features missed in linear correlation analyses. However, as mutual information is symmetric in its arguments, it only has the ability to reveal the probability that two variables are related. It provides no information as to how they are related; specifically, causal interactions or a relation based on a common cause cannot be detected. For this reason we also investigate the utility of a related quantity called the transfer entropy. The transfer entropy can be written as a difference between mutual informations and has the capability to reveal whether and how the variables are causally related. The application of these information theoretic measures is rested on some familiar examples using data from the International Satellite Cloud Climatology Project (ISCCP) to identify relation between global cloud cover and other variables, including equatorial Pacific sea surface temperature (SST), over seasonal and El Niño Southern Oscillation (ENSO) cycles.

Author

*Climatology; Information Theory; Bayes Theorem; Clouds (Meteorology); Satellite Observation*

**20030014795** Cincinnati Univ., Dept. of Environmental Health, OH USA

**Personal Aerosol Sampler for Occupational Environments Final Report, 1 Feb. 1998 - 31 Jan. 02**

Grinshpun, S. A.; Apr. 25, 2002; 16p; In English

Report No.(s): PB2003-102368; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A new concept for personal aerosol sampling was developed by Drs. Grinshpun and Willeke during the period of 1995-97. They designed a prototype sampler with a curved, porous inlet and a 25-mm collection filter directly behind the inlet. The design allowed avoiding transmission losses in the sampler and made its aspiration efficiency less sensitive to the ambient wind speed. The preliminary study demonstrated several advantageous features of the new device: the physical sampling efficiency of the device was confirmed to have low sensitivity to ambient air conditions, such as wind speed and direction; and the filter samples showed high uniformity of the particle deposits. The sampler prototype was further modified by SKC Inc. that made it commercially available in 1997 (marketed as the 'Button Aerosol Sampler'). This grant was funded by NIAOSH in 1998 to evaluate the performance of the new Button Aerosol Sampler in the laboratory and in the field. The primary goal was to determine whether the new concept and device can be successfully utilized for the assessment of worker exposure in occupational environments contaminated with airborne dust and microorganisms.

NTIS

*Aerosols; Portable Equipment; Industrial Safety; Sampling; Samplers*

**20030014813** NASA Goddard Space Flight Center, Greenbelt, MD USA

**A Wavelet Based Suboptimal Kalman Filter for Assimilation of Stratospheric Chemical Tracer Observations**

Auger, Ludovic, Centre National de Recherches Meteorologiques, France; Tangborn, Andrew, NASA Goddard Space Flight Center, USA; [2002]; 26p; In English; Original contains color illustrations; Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche; Distribution as joint owner in the copyright; Distribution as joint owner in the copyright

A suboptimal Kalman filter system which evolves error covariances in terms of a truncated set of wavelet coefficients has been developed for the assimilation of chemical tracer observations of CH<sub>4</sub>. The truncation is carried out in such a way that the resolution of the error covariance, is reduced only in the zonal direction, where gradients are smaller. Assimilation experiments which last 24 days, and used different degrees of truncation were carried out. These reduced the covariance, by 90, 97 and 99 % and the computational cost of covariance propagation by 80, 93 and 96 % respectively. The difference in both error covariance and the tracer field between the truncated and full systems over this period were found to be not growing in the first case, and a

growing relatively slowly in the later two cases. The largest errors in the tracer fields were found to occur in regions of largest zonal gradients in the tracer field.

Author

*Wavelet Analysis; Kalman Filters; Stratosphere*

**20030016538** Iowa State Univ. of Science and Technology, Ames, IA USA

**Annual Site Environmental Report Calendar Year 2001**

2002; 60p; In English

Report No.(s): DE2002-799867; IS-5150; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The primary purpose of this report is to summarize the performance of Ames Laboratory's environmental programs, present highlights of significant environmental activities, and confirm compliance with environmental regulations and requirements for calendar year 2001. This report is a working requirement of Department of Energy Order 231.1, Environment, Safety, and Health Reporting.

NTIS

*Health; Safety; Regulations*

**20030016539** Rocky Mountain Oilfield Testing Center, Casper, WY USA

**Test to Illustrate the Effects of Ecosafe on the Movement of Oil in Contaminated Soils**

Jackson, L. M.; Mar. 04, 2002; 40p; In English

Report No.(s): DE2002-793465; DOE/RMOTC-02164; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

An ECOSAFE(trademark) solution was tested at 1 part to 100 milliliters of de-ionized water against a control set using de-ionized water only. Each soil column received five and one-quarter treatments of either ECOSAFE(trademark) solution or de-ionized water over two and one-half days. Air was injected following saturation of the columns and leachate recovery. Soil samples were collected from each column on the final day. The total volume of water added to the Control Column was 6.150 milliliters. The laboratory homogenized 2500 ml of water and removed 75 ml of free crude oil product before analysis. of that, 1,000 milliliters was analyzed for TPH content and 1,000 milliliters was analyzed for Diesel Range Organics using EPA Method 1664 and 8015 Modified, respectively. The sample contained 17 mg/L of TPH and 34 mg/L of Diesel Range Organics. The total volume of water added to the Test Column was 5,850 milliliters. The samples were analyzed for TPH content and Diesel Range Organics using EPA Method 1664 and 8015 Modified, respectively. The sample contained 15 mg/L of TPH and 500 mg/L of Diesel Range Organics.

NTIS

*Soil Pollution; Petroleum Products; Soil Sampling; Contamination*

**20030016540** Rocky Mountain Oilfield Testing Center, Casper, WY USA

**Soil Remediation Test Final Report**

Manlapig, D. M.; Williams, W.; Apr. 01, 2002; 12p; In English

Report No.(s): DE2002-793446; DOE/RMOTC-020121; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Soils contaminated with petroleum by-products can now be effectively remediated using a variety of technologies. Among these are in-situ bioremediation, land farming, and landfill/replacing of soil. The range of efficiencies and cost effectiveness of these technologies has been well documented. Exsorbet Plus is showing promise as an in-situ bioremediation agent. It is made of naturally grown Spaghnum Peat Moss which has been activated for encapsulation and blended with nitrogen-rich fertilizer. In its initial field test in Caracas, Venezuela, it was able to remediate crude oil-contaminated soil in 90 days at less than half of the cost of competing technologies. Waste Solutions, Corp and the US Department of Energy signed a Cooperative Research and Development Agreement to test Exsorbet Plus at the Rocky Mountain Oilfield Testing Center near Casper, Wyoming. As part of the test, soil contaminated with crude oil was treated with Exsorbet Plus to aid the in-situ bioremediation process. Quantitative total petroleum hydrocarbon (TPH) measurements were acquired comparing the performance of Exsorbet Plus with an adjacent plot undergoing unaided in-situ bioremediation.

NTIS

*Petroleum Products; Soil Pollution; Energy Technology; Peat*

**20030016581** Southern Research Inst., Birmingham, AL USA

**Southern Fine Particulate Monitoring Project. Fifth Quarterly Progress Report *Progress Report***

Williamson, A. D.; Jan. 2002; In English

Report No.(s): DE2002-791992; No Copyright; Avail: CASI; C01, CD-ROM

This quarterly report presents results and analysis of continuous onsite ambient fine particulate data at the North Birmingham sampling site during the October - December, 2001 study period. The continuous data include PM<sub>2.5</sub> mass concentrations measured by TEOM, particle sulfate using the R&P 8400S monitor, particle size distributions measured by SMPS and APS monitors, and PM<sub>2.5</sub> light scattering extinction coefficient as measured by nephelometer. The persistent daily trends described in the previous quarterly report are seen in the fall particulate data, superimposed on the seasonal trend toward lower concentrations in the cooler months. Some instrumental issues were noted with the APS and the sulfate monitoring instruments, as described in the main report.

NTIS

*Particulates; Attenuation Coefficients; Light Scattering*

**20030016603** Christopher Newport Univ., Newport News, VA USA

**Validation of the Measurement of Pollution in the Troposphere (MOPITT) Experiment by Ground-Based Infrared Solar Spectroscopic Measurements of Carbon Monoxide (CO) and Methane (CH<sub>4</sub>) *Final Report***

Pougatchev, Nikita, Christopher Newport Univ., USA; Jan. 22, 2003; 16p; In English

Contract(s)/Grant(s): NAG5-6503; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The goal of the MOPITT experiment is to enhance our knowledge of the lower atmosphere system and particularly how it interacts with the surface/ocean/biomass systems. The particular focus is the distribution, transport, sources and sinks of carbon monoxide and methane in the troposphere. The MOPITT instrument was launched on EOS TERRA satellite December 18, 1999. After the launch and until March 22, 2000 the MOPITT instrument was in engineering and calibration mode. Beginning March 23, 2000 through May 6, 2001 the instrument was in a science measurement mode with some calibration breaks. On May 7, 2001 a cryocooler on a side B died and channels 1 - 4 became inoperational. The MOPITT resumed its scientific measurements on August 25, 2001 with channels 5 - 8. With some calibration breaks the instrument currently provides the data. The project has three elements to it: hardware, data analysis and modeling. The MOPITT instrument, on the NASA EOS Terra satellite, measures the upwelling infrared radiance. Using the technique of correlation spectroscopy, information regarding the distribution of atmospheric CO and CH<sub>4</sub> can be extracted. By using appropriate data analysis techniques, concentration profiles of CO are currently obtained on a global basis at a reasonably high horizontal (approximately 22km) and vertical resolution (approximately 3km). Column amounts of methane will be derived over the sunlit side of the orbit. These profiles are assimilated into models to study the chemistry and dynamics of CO, CH<sub>4</sub> and other constituents of the lower atmosphere.

Author

*Troposphere; Atmospheric Chemistry; Atmospheric Models; Transport Properties; Satellite Instruments; Ocean Dynamics; Carbon Monoxide; Methane*

**20030016700** Office of Air Quality Planning and Standards, Research Triangle Park, NC USA

**Quality Assurance Guidance Document: Model Quality Assurance Project Plan for the National Air Toxics Trends Stations**

Mikel, D. K.; Dec. 2002; 150p; In English

Report No.(s): PB2003-102389; EPA/454/R-02/007; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

The document represents the model Quality Assurance Project Plan (QAPP) for the National Air Toxics Trends Stations (NATTS). The Office of Air Quality Planning and Standards (OAQPS) staff developed this Model QAPP to serve as an example of the type of information and detail necessary for the documents that will be submitted by State, Local or Tribal Air Toxics Monitoring Programs (ATMP) involved in the NATTS. This model QAPP was generated using the EPA QA regulations and guidance as described in EPA QA/R- 5, EPA Requirements for Quality Assurance Project Plans and the accompanying document, EPA QA/G-5, Guidance for Quality Assurance Project Plans. Data in this QAPP should not be used by organizations to meet the data quality needs for ATMP, with the exception of Chapter 7, which describes the Data Quality Objectives (DQO) for the national program. Since all NATTS will be part of this trends network, OAQPS requires that the DQOs be identical. If an agency wishes to add DQOs to Chapter 7 that go beyond the needs of the national trends objectives, then this should be addressed in Chapter 7 and 24. Chapter 24 discusses the Data Quality Assessments (DQAs) for a local objective, which is not based on the DQOs in

Chapter 7. Please note that Chapter 24 states that the national DQA will be performed by OAQPS. The Standard Operation Procedures (SOPs) listed in the Table of Contents are a guidance document developed for OAQPS for the NATTS.

NTIS

*Air Quality; Air Pollution; Toxicology; Environmental Monitoring*

**20030016711** Swedish Water and Air Pollution Research Lab., Stockholm, Sweden

**Deposition and Run-Off of Metals, Sulphur, and Nitrogen Close to the Ronnskar Metal Work, 1986-2001** *Deposition och Avrinning av Metaller, Svavel och Kvaeve vid Holmsvattnet naera Roennskaersverken 1986-2001*

Knulst, J. C.; Westling, O.; Dec. 2002; 32p; In Swedish

Report No.(s): PB2003-102617; IVL-B-1480; Copyright; Avail: National Technical Information Service (NTIS), Microfiche

This study is based on monitoring of atmospheric deposition and run-off of sulphur, nitrogen and heavy metals 17 km SSW of a smelter at Ronnskar along the northeastern coast of Sweden. Measurements during the period 1986 to 2001 showed decreasing deposition of sulphur to open field and Norway spruce forest (throughfall). The deposition of heavy metals to open field and spruce forest decreased by 50-83% between 1986 and 2001. Overall annual precipitation increased during the 1990's and was greatest 2000/01. This even caused deposition of sulphur and nitrate to be somewhat higher the last year than between 1994 and 2000. Of the investigated metals, only copper and lead concentrations were higher than general background levels for this area.

NTIS

*Nitrogen; Deposition; Heavy Metals; Sulfur*

**20030017761** California Univ., Lawrence Berkeley National Lab., Berkeley, CA USA

**How Long Can You Go. Low Pressure Drop Laboratory Design**

Weale, J.; Rumsey, P.; Dartor, D.; Lock, L. E.; Dec. 21, 2001; 16p; In English; Prepared in cooperation by Rumsey Engineers, Oakland, CA

Report No.(s): DE2002-801935; LBNL-49366; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Laboratory buildings are characterized by the production of potentially hazardous fumes within the occupied space. The primary objective of a laboratory ventilation system is to isolate and protect the occupants from the fumes, as well as provide minimum outside air at a comfortable temperature. Fume removal results in the need for a large volume of conditioned make-up air, typically a significantly greater volume than required for space temperature conditioning purposes. The high quantity of exhaust naturally results in a once through system, which is also often required by codes that prohibit any recirculation in a laboratory space. The high costs associated with high airflow systems are magnified by the 24 hours a day, 356 days a year ventilation operation often seen in laboratory situations. All too often, the common design approach taken to laboratory mechanical systems results in a traditional office ventilation system upsized to meet a laboratory's requirements.

NTIS

*Laboratories; Design Analysis; Low Pressure; Air Pollution; Pollution Control*

## 46

### GEOPHYSICS

*Includes earth structure and dynamics, aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism. For related information see 47 Meteorology and Climatology; and 93 Space Radiation.*

**20030014808** NASA Langley Research Center, Hampton, VA USA

**Overview of Atmospheric Ionizing Radiation (AIR) Research: SST - Present**

Wilson, J. W., NASA Langley Research Center, USA; Goldhagen, P., Environmental Measurements, Inc., USA; Rafnsson, V., Iceland Univ., Iceland; Clem, J. M., Delaware Univ., USA; DeAngelis, G., Old Dominion Univ., USA; Friedberg, W., Civil Aerospace Medical Inst., USA; [2002]; 14p; In English; World Space Congress 2002, 10-19 Oct. 2002, Houston, TX, USA; Original contains color illustrations; Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche; Distribution as joint owner in the copyright; Distribution as joint owner in the copyright

The Supersonic Transport (SST) program, proposed in 1961, first raised concern for the exposure of pregnant occupants by solar energetic particles (SEP), and neutrons were suspected to have a main role in particle propagation deep into the atmosphere. An eight-year flight program confirmed the role of SEP as a significant hazard and of the neutrons as contributing over half of the galactic cosmic ray (GCR) exposures, with the largest contribution from neutrons above 10 MeV. The FAA Advisory Committee on the Radiobiological Aspects of the SST provided operational requirements. The more recent (1990) lowering of recommended exposure limits by the International Commission on Radiological Protection with the classification of aircrew as

"radiation workers" renewed interest in GCR background exposures at commercial flight altitudes and stimulated epidemiological studies in Europe, Japan, Canada and the USA. The proposed development of a High Speed Civil Transport (HSCT) required validation of the role of high-energy neutrons, and this resulted in ER-2 flights at solar minimum (June 1997) and studies on effects of aircraft materials on interior exposures. Recent evaluation of health outcomes of DOE nuclear workers resulted in legislation for health compensation in year 2000 and recent European aircrew epidemiological studies of health outcomes bring renewed interest in aircraft radiation exposures. As improved radiation models become available, it is imperative that a corresponding epidemiological program of US aircrew be implemented.

Author

*Atmospheric Radiation; Ionizing Radiation; Supersonic Transports; General Overviews; Research and Development; Space Flight; Epidemiology*

**20030014850** Royal Society of Canada, Ottawa, Ontario Canada

**WIRGO in TIC's? [What (on Earth) is Really Going On in Terrestrial Impact Craters?]**

Dence, Michael R., Royal Society of Canada, Canada; Impact Cratering: Bridging the Gap Between Modeling and Observations; 2003, pp. 20; In English; Also announced as 20030014839; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Canada is well endowed with impact craters formed in crystalline rocks with relatively homogeneous physical properties. They exhibit all the main morphological-structural variations with crater size seen in craters on other rocky planets, from small simple bowl to large peak and ring forms. Lacking stratigraphy, analysis is based on the imprint of shock melting and metamorphism, the position of the GPL (limit of initial Grady-Kipp fracturing due to shock wave reverberations) relative to shock level, the geometry of late stage shears and breccias and the volume of shocked material beyond the GPL. Simple craters, exemplified by Brent ( $D = 3.7$  km) allow direct comparison with models and experimental data. Results of interest include: 1. The central pool of impact melt and underlying breccia at the base of the crater fill is interpreted as the remnant of the transient crater lining; 2. The overlying main mass of breccias filling the final apparent crater results from latestage slumping of large slabs bounded by a primary shear surface that conforms to a sphere segment of radius,  $r(\text{sub } s) \text{ approx.} = 2d(\text{sub } tc)$ , where  $d(\text{sub } tc)$  is the transient crater depth; 3. The foot of the primary shear intersects above the GPL at the centre of the melt pool and the rapid emplacement of slumped slabs produces further brecciation while suppressing any tendency for the centre to rise. In the autochthonous breccias below the melt and in the underlying para-allochthone below the GPL, shock metamorphism weakens with depth. The apparent attenuation of the shock pulse can be compared with experimentally derived rates of attenuation to give a measure of displacements down axis and estimates of the size of a nominal bolide of given velocity, the volume of impact melt and the energy released on impact. In larger complex craters (e.g. Charlevoix,  $D = 52$  km) apparent shock attenuation is low near the centre but is higher towards the margin. The inflection point marks the change from uplift of deep material in the centre to subsidence of near-surface material at the margins. From the observed general relationship  $P(\text{sub } GPL) = 3.5 D(\text{sup } 0.5)$ , where  $P(\text{sub } GPL)$  (in GPa) is the estimated level of shock metamorphism at the Grady-Kipp fracture limit, it is apparent that the differential stress due to shock wave reflections weakens at about twice the attenuation rate of the initial shock pulse. Thus, with increasing size, compression of the para-autochthone below the GPL plays an increasingly larger role in controlling the depth of the transient crater and hence the radius of the primary shear. It follows that, where the rate of relaxation of the para-autochthone is more rapid than the propagation of the primary shear from the rim towards the centre, the shear surface intersects below the GPL and central uplift occurs.

Author

*Craters; Crystallinity; Depth; Displacement; Impact Melts; Planets; Shock Waves*

**20030014854** Natural Resources Canada, Earth Sciences Sector, Ottawa, Ontario Canada

**Observations of the Terrestrial Impact Cratering Record**

Grieve, R. A. F., Natural Resources Canada, Canada; Impact Cratering: Bridging the Gap Between Modeling and Observations; 2003, pp. 25-26; In English; Also announced as 20030014839; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The currently known terrestrial record of impact cratering stands at over 160 impact structures and several new examples are identified each year. The record, however, is a biased sample of an originally much larger population, favoring younger, larger structures in geologically stable areas of the Earth's continental crust. The largest and oldest known structures are limited to diameters of approx. 250-300 km and ages of less than 2 Ga. Care must be taken, therefore, in making generalised statements regarding the record with respect to such time-integrated effects as variations in cratering rate, periodicities, etc. The terrestrial

record, however, does provide cumulative observations of aspects of the cratering process and is the only available source of ground truth with respect to the structural and lithological results of large-scale natural impact events.

Author

*Terrestrial Planets; Impact; Cratering; Observation; Diameters*

**20030014855** Geological Survey, Menlo Park, CA USA

**Antipodal Hotspots on Earth: Are Major Deep-Ocean Impacts the Cause?**

Hagstrum, J. T., Geological Survey, USA; Impact Cratering: Bridging the Gap Between Modeling and Observations; 2003, pp. 27; In English; Also announced as 20030014839; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Hotspot volcanism on Earth is restricted to relatively small areas, on the order of 100 km in diameter, and is generally believed to result from narrow upwellings of hot mantle material called "plumes". At first glance, hotspots appear randomly distributed. General associations with geoid highs and divergent plate margins have been noted, and hotspots tend to occur in provinces separated by spotless areas. Matyska investigated angular symmetries of hotspot distributions, and showed that the highest maxima were obtained with 180 deg. rotations. Rampino and Caldeira also conducted a statistical analysis of large and small data sets and found that more hotspots occur as nearly antipodal pairs than would be expected from random distributions. The rise of antipodal plumes from the core-mantle boundary through a convecting mantle seems unlikely, but axial focusing of an impact's energy by the spherical Earth might underlie the antipodal pairing of hotspots. Such a focusing mechanism has been proposed to explain seismically disrupted terrains antipodal to major impact basins on the Moon and Mercury, and to have formed fractured crust on Mars opposite the Hellas basin-perhaps later exploited as a conduit for volcanism at Alba Patera. First-order problems with this model for Earth, however, include the expected low seismic efficiency of impacts and the lack of any volcanic features opposite large continental impact structures (e.g. Chicxulub).

Author

*Volcanoes; Structural Basins; Plumes; Mars Volcanoes; Mars Surface; Impact; Ocean Bottom*

**20030014857** Budapest Science Univ., Dept. of Physical Geography, Hungary

**Pyroclastic Flows and Surges: Possible Analogy for Crater Ejecta Deposition**

Hargitai, H., Budapest Science Univ., Hungary; Kereszturi, A., Budapest Science Univ., Hungary; Impact Cratering: Bridging the Gap Between Modeling and Observations; 2003, pp. 29; In English; Also announced as 20030014839; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

We analyse a possible model of the crater ejecta development and deposition with pyroclastic flows and surges. Because several of their characteristics and depositional structures are known and observable on the Earth it is useful to try to find resembling phases of the crater ejecta formation.

Author

*Observation; Ejecta; Deposition; Craters*

**20030014862** Washington Univ., Seattle, WA USA

**What Do We Need to Know to Model Impact Processes?**

Holsapple, K. A., Washington Univ., USA; Impact Cratering: Bridging the Gap Between Modeling and Observations; 2003, pp. 34-35; In English; Also announced as 20030014839; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The computer modeling of hyper-velocity impacts into planetary bodies is one of the most challenging computer tasks we attempt. The physical states encountered in impact events can begin with pressures measured in gigabars and temperatures measured in hundreds of electron-volts, and then proceed all the way down to the ordinary partial bars of pressure and few degrees of temperature as in our common experience in terrestrial soils and rocks. The interest in planetary science applications spans not only those common terrestrial soils and rocks, but also gases, ices at extreme low temperatures, and very loose, rubble-pile materials that could not even with-stand the pressures of the Earth's gravity without crumbling.

Derived from text

*Computerized Simulation; Computer Techniques; Models; Impact*

**20030014863** Boeing Co., Seattle, WA USA

**Effects of Target Properties on the Cratering Process**

Housen, K. R., Boeing Co., USA; Impact Cratering: Bridging the Gap Between Modeling and Observations; 2003, pp. 36-37; In English; Also announced as 20030014839; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Impact events in the solar system occur in a variety of materials, ranging from the rocky surfaces of the terrestrial planets to the icy mantles of the satellites of the outer planets to the undoubtedly highly fractured and porous materials that make up many asteroids and comets. A major challenge to impact modelers has been to understand how the composition and mechanical properties of these varied target materials dictate the outcome of an impact event. Four sources of information have historically been used to study this problem.

Derived from text

*Targets; Compacting; Cratering; Compression Loads; Mechanical Properties; Geology*

**20030014864** Academy of Sciences (USSR), Inst. for Dynamics of Geospheres, Moscow, USSR

**Complex Crater Formation: Verification of Numerical Models**

Ivanov, B. A., Academy of Sciences (USSR), USSR; Impact Cratering: Bridging the Gap Between Modeling and Observations; 2003, pp. 38; In English; Also announced as 20030014839; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The growing capability of modern computers offers increased possibilities for numerical modeling of impact crater formation. However, complex crater formation include various particular models of rock massifs dynamical behavior in a wide range of thermodynamic parameters and strain rates. At the same time geological and geophysical investigations of impact craters give only the final structure of craters and geophysical fields around. The verification of numerical models should take into account comparison of computed results with maximum possible set of observational data.

Author

*Cratering; Mathematical Models; Thermodynamic Properties; Geological Surveys*

**20030014865** Academy of Sciences (USSR), Inst. for Dynamics of Geospheres, Moscow, USSR

**Educational Experience in Numerical Modeling of Impact Cratering**

Ivanov, B. A., Academy of Sciences (USSR), USSR; Impact Cratering: Bridging the Gap Between Modeling and Observations; 2003, pp. 39; In English; Also announced as 20030014839; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The growing capability of the impact crater numerical modeling makes actual questions how to attract young students to the research and how to educate students specialized in general geology and geophysics. An experience in this direction has been accumulated in September 2002 during the ESF IMPACT Short Course "Numerical Modeling of Impact Crater Formation". The goal of the short course was to introduce basics of the numerical modeling techniques to non-professionals. "Non-professional" in this context means that the course was oriented to students and post-docs without a special background in computer science, shock wave physics and rock mechanics. However, most of students have an experience in impact crater related researches. Hence, all of them was highly motivated by their previous education and current research activity.

Author

*Education; Mathematical Models; Cratering; Impact Damage*

**20030014866** Academy of Sciences (USSR), Inst. for Dynamics of Geospheres, Moscow, USSR

**Modification of ANEOS for Rocks in Compression**

Ivanov, B. A., Academy of Sciences (USSR), USSR; Impact Cratering: Bridging the Gap Between Modeling and Observations; 2003, pp. 40; In English; Also announced as 20030014839; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The Analytical Equation of State (ANEOS) is a useful computer code to generate equations of state (EOS) for rocks and minerals. An accurate EOS is one of essential points necessary for the numerical modeling of impact events. We analyze here a possibility to use a "standard" ANEOS in a "non-standard" way to make more flexible the procedure of an EOS construction.

Author

*Mathematical Models; Equations of State; Rocks; Compressing*

**20030014867** Tartu Univ., Inst. of Geology, Tartu, Estonia

**Cooling of the Kardla Impact Crater, 2, Impact and Geothermal Modelling**

Joeleht, A., Tartu Univ., Estonia; Kirsimae, K., Tartu Univ., Estonia; Versh, E., Tartu Univ., Estonia; Plado, J., Tartu Univ., Estonia; Ivanov, B., Academy of Sciences (USSR), USSR; Impact Cratering: Bridging the Gap Between Modeling and Observations; 2003, pp. 41; In English; Also announced as 20030014839; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Hydrothermal mineralization has occurred in many impact craters including also a 4-km marine complex crater in Kardla, Estonia. Mineralogical and fluid inclusion data provide temperature ranges for different mineralization events and, thus, giving a starting point for modelling. Modelling includes both: (1) impact modelling to get the structure and temperature distribution in

crater rocks right after the impact, and (2) geothermal modelling to get information on heat transfer processes and time-scale of post-impact cooling.

Author

*Craters; Cooling; Geothermal Anomalies; Models; Impact*

**20030014868** Kiel Univ., Inst. for Geosciences, Germany

**Seismic Investigation and Numerical Modeling of the Lake Bosumtwi Impact Crater**

Karp, T., Kiel Univ., Germany; Artemieva, N. A., Academy of Sciences (USSR), USSR; Milkereit, B., Toronto Univ., Canada; Impact Cratering: Bridging the Gap Between Modeling and Observations; 2003, pp. 42; In English; Also announced as 20030014839

Contract(s)/Grant(s): DFG-Ja-290/15-2; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The Lake Bosumtwi impact crater, Ghana, (age 1.07 Ma, diameter 10.5 km) is one of the youngest and best-preserved complex terrestrial impact structures. It was excavated from hard crystalline target rock and is the source of the Ivory Coast tektite strewn field. It is almost entirely filled by the Lake Bosumtwi.

Author

*Mathematical Models; Seismology; Craters; Lakes; Impact Damage*

**20030014871** Wien Univ., Inst. of Geochemistry, Austria

**Using Geochemical Observations to Constrain Projectile Types in Impact Cratering**

Koeberl, Christian, Wien Univ., Austria; Impact Cratering: Bridging the Gap Between Modeling and Observations; 2003, pp. 45-46; In English; Also announced as 20030014839; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Breccias and melt rocks found at possible meteorite impact structures on Earth may contain a minor extraterrestrial component. In the absence of evidence of shock metamorphic effects in such rocks, the unambiguous detection of an extraterrestrial component can be of diagnostic value regarding the impact origin of a geological structure. The verification of an extraterrestrial component in impact-derived melt rocks or breccias can be of diagnostic value to provide confirming evidence for an impact origin of a geological structure. Similar approaches are of great value in the investigation of distal ejecta layers (as we are taught by the case history of the Cretaceous-Tertiary boundary). Qualitatively speaking, a small amount of the finely dispersed meteoritic melt or vapor is mixed during the impact event with a much larger quantity of target rock vapor and melt, and this mixture later forms impact melt rocks, melt breccias, or impact glass. In most cases, the contribution of meteoritic matter to these impactite lithologies is very small (much less than 1%), leading to only slight chemical changes in the resulting impactites. Geochemical methods can be used to determine the amount of such a meteoritic component (see below). However, there are plenty of open questions.

Author

*Breccia; Cratering; Geochemistry; Geology; Impact Melts; Meteorite Collisions; Meteoritic Composition*

**20030014872** California Inst. of Tech., Div. of Geological and Planetary Sciences, Pasadena, CA USA

**Amelia Creek, Northern Territory, Australia: A 20 x 12 km Oblique Impact Structure with No Central Uplift**

Macdonald, F. A., California Inst. of Tech., USA; Mitchell, K., Mitchell (K.), Australia; Impact Cratering: Bridging the Gap Between Modeling and Observations; 2003, pp. 47; In English; Also announced as 20030014839; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The Amelia Creek Structure is located in the Davenport Ranges of the Northern Territory, Australia at lat. 20 deg. 55 sec.S, long. 134 deg. 50 sec.E. Shock metamorphic features are developed on the southern, downrange side of the structure. No central uplift is developed and the dimensions of the impact structure are at least 20 X 12 km.

Author

*Downrange; Impact*

**20030014873** NASA Ames Research Center, Moffett Field, CA USA

**Goldilocks and the Three Complex Crater Scaling Laws**

McKinnon, William B., Washington Univ., USA; Schenk, Paul M., Lunar and Planetary Inst., USA; Moore, Jeffrey M., NASA Ames Research Center, USA; Impact Cratering: Bridging the Gap Between Modeling and Observations; 2003, pp. 48; In English; Also announced as 20030014839; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Formed in the gravity regime, complex craters are larger than their simple crater equivalents, due to a combination of slumping and uplift. Just how much larger is a matter of great interest for, for example, age dating studies. We examine three

empirical scaling laws for complex crater size, examining their strengths and weaknesses, as well as asking how well they accord with previously published and new data from lunar, terrestrial, and venusian craters.

Author

*Gravitation; Lunar Craters; Time Measurement*

**20030014875** New Mexico Univ., Dept. of Earth and Planetary Sciences, Albuquerque, NM USA

**Limits of the Presence of Impact-Induced Hydrothermal Alteration in Small Impact Craters on the Earth: Implications for the Importance of Small Craters on Mars**

Newsom, H. E., New Mexico Univ., USA; Hagerty, J. J., New Mexico Univ., USA; Impact Cratering: Bridging the Gap Between Modeling and Observations; 2003, pp. 51; In English; Also announced as 20030014839; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Impact craters on the earth contain evidence for hydrothermal activity. An important property of small craters is the limit to the amount of energy deposited during the impact that can lead to hydrothermal activity. Hydrothermal activity is potentially important for producing alteration minerals, trapping water, and transporting mobile elements to the martian surface. Hydrothermal systems in impact craters may also be important for astrobiological investigations in terms of providing environments for organic chemical processes to occur and as near-surface locations that could be easily investigated by surface exploration missions. Another important reason for understanding the lower limit on thermal effects for small craters is in the use of small superimposed craters as probes of larger craters during surface missions. If hydrothermal material is found associated with superimposed craters it will be important to distinguish between hydrothermal events associated with the earlier versus the later crater. In the future, comparisons of our observations with numerical models for the formation of small craters can lead to a better understanding of the role of small craters on Mars.

Author

*Hydrothermal Systems; Impact Damage; Craters; Earth (Planet); Mars Craters*

**20030014876** Tokyo Univ., Dept. of Earth and Planetary Science, Japan

**Sulfur Chemistry in K/T-Sized Impact Vapor Clouds**

Ohno, S., Tokyo Univ., Japan; Sugita, S., Tokyo Univ., Japan; Kadono, T., Japan Marine Science and Technology Center, Japan; Hasegawa, S., Institute of Space and Astronautical Science, Japan; Igarashi, G., Tokyo Univ., Japan; Impact Cratering: Bridging the Gap Between Modeling and Observations; 2003, pp. 52; In English; Also announced as 20030014839; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The geologic record indicates that the mass extinction at K/T boundary, 65 Myrs ago, was caused by a hypervelocity impact of an asteroid or a comet. During the K/T impact event, a large amount of sulfur was degassed from the impact site. The degassed sulfur converts to sulfuric acid aerosol and stays in the stratosphere for a long time. This reduces the sunlight significantly and leads to a mass extinction. However, if the degassed sulfur is dominated by SO<sub>3</sub> not SO<sub>2</sub>, then the conversion to sulfuric acid aerosol occurs very rapidly and the blockage of sunlight does not last for a long time. The chemical reaction of sulfur-oxides in an impact vapor cloud, nevertheless, has not been studied in detail previously, and the SO<sub>2</sub>/SO<sub>3</sub> ratio in a vapor cloud is yet highly uncertain. The purpose of this study is to estimate the SO<sub>2</sub>/SO<sub>3</sub> ratio in the K/T impact vapor cloud. Here we discuss the results of calculation of chemical equilibrium and kinetics of sulfur-containing species in an impact vapor cloud as well as mass spectroscopic analysis of vapor plumes created by laser irradiation on anhydrite.

Author

*Vapors; Clouds (Meteorology); Sulfur; Chemical Reactions; Cretaceous-Tertiary Boundary*

**20030014877** California Inst. of Tech., Lindhurst Lab. of Experimental Geophysics, Pasadena, CA USA

**Impact Induced Target Thermo-Mechanical State and Particle Motion Histories**

O'Keefe, John D., California Inst. of Tech., USA; Ahrens, Thomas J., California Inst. of Tech., USA; Impact Cratering: Bridging the Gap Between Modeling and Observations; 2003, pp. 53-54; In English; Also announced as 20030014839; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The first objective of this effort is to determine how the post impact measurable crater features relate to the processes that take place during impact and the second is to determine from a given suite of measurements the uncertainty in estimating the impactor's parameters. Approach. We have taken a numerical approach using the CTH code[1] to calculate the evolution of the near field impact process. This includes the de-tails of the early time shock wave driven flow fields, the development and collapse of the transient cavity, and in a few limited cases the very late time thermal and stress histories. to quantify the impact process, we placed massless tracer particles in layers that simulate the target stratigraphy and stored the motion and thermo-mechanical state histories (e.g. pressure, temperature, damage, peak stress/strain rate..) of these particles. We took this approach because the

late time distributions are significantly different from the initial distributions. We used the ANEOS model for equation of state and a Mohr-Coulomb damage model for the strength degradation by shear strain fracture. The key parameters for the impacts are  $a$ , the impactor radius,  $U$ , the impactor velocity,  $Y_c$ , target cohesive strength,  $\mu$ , internal friction,  $\mu_d$ , damaged internal friction. We found that we could replicate the key features with values of target material parameters within the magnitudes found in laboratory measurements. We developed scaling laws for the key target metrics based upon the Mohr-Coulomb strength model. This provides a link between the measurable features and the impactor parameters. In addition, it bounds the effect of damage on the magnitude of the metrics.

Author

*Impactors; Thermal Stresses; Thermodynamics; Cavities; Craters; Damage; Particle Motion*

**20030014878** Institute of Space and Astronautical Science, Sagamihara, Japan

**Velocity Distributions of Fragments and Its Time Dependence**

Onose, N., Institute of Space and Astronautical Science, Japan; Fujiwara, A., Institute of Space and Astronautical Science, Japan; Impact Cratering: Bridging the Gap Between Modeling and Observations; 2003, pp. 55; In English; Also announced as 20030014839; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Oblique impact cratering experiments were done, and the fragment size and velocity were measured for fragments larger than 1mm in diameter, and slower than 200m/sec. A high speed CCD video camera was used to see the fragments in flight, and secondary collisions with a window of the target chamber. The purpose of this paper is to provide a database of fragments velocity, which is essential to deeper understanding of the surface evolution of small asteroids.

Author

*Velocity Distribution; Fragments; Time Dependence; Cratering*

**20030014879** Institute of Space and Astronautical Science, Sagamihara, Japan

**Velocity Distributions of Fragments in Oblique Impact Cratering on Gypsum**

Onose, N., Institute of Space and Astronautical Science, Japan; Fujiwara, A., Institute of Space and Astronautical Science, Japan; Impact Cratering: Bridging the Gap Between Modeling and Observations; 2003, pp. 56; In English; Also announced as 20030014839; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

In order to understand the behavior of the impact-induced fragments on the small asteroid, oblique impact cratering experiments were produced using gypsum targets, which were used as one of porous and low density materials. The fragment size and velocity were measured for fragments larger than 1mm in diameter, and slower than 200m/sec. A high speed CCD video camera was used to see the fragments in flight, and secondary collisions with a window of the target chamber were also employed to measure fragment velocity. Especially, we focused to measure the behaviors of very low velocity fragments, which have special meaning for the ejecta on very small asteroids.

Author

*Velocity Distribution; Fragmentation; Impact Damage; Cratering; Porous Materials; Gypsum*

**20030014880** Instituto Nacional de Tecnica Aeroespacial, Centro de Astrobiologia, Torrejon de Ardoz, Spain

**Next Step in Marine Impact Studies: Combining Geological Data with Numerical Simulations for Applications in Planetary Research**

Ormo, J., Instituto Nacional de Tecnica Aeroespacial, Spain; Impact Cratering: Bridging the Gap Between Modeling and Observations; 2003, pp. 57; In English; Also announced as 20030014839; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Baltoscandia is favourable for geological studies of marine-target (M-T) craters. One reason is the relatively dense population of craters of different diameters, of approximately the same age, and with different target water depths. This allows comparative studies of the effects of a target water layer on the lithologies and morphologies of the resulting craters. Baltoscandian craters like Kardla and Lockne are well documented. Today, a considerable number of the documented craters and impact sites on Earth are known to have formed at sea. All but one, the Eltanin impact site west of Chile, have formed in epicontinental seas. This circumstance is mainly a result of higher probability of both formation and preservation in such areas. Famous craters as Chicxulub, Chesapeake Bay, and Mjolnir were also formed at sea. Marine impact cratering is an important topic within impact research. The fact that our planet is mostly covered by water must be taken into consideration when evaluating consequences and hazards from impact events. In addition, M-T craters may have applications in the exploration of our Solar System.

Author

*Marine Environments; Impact; Geology; Data Acquisition; Numerical Analysis; Planetary Composition*

**20030014881** New Brunswick Univ., Planetary and Space Science Centre, Fredericton, New Brunswick Canada

**Transient Crater Formation and Collapse: Observations at the Houghton Impact Structure, Arctic Canada**

Osinski, G. R., New Brunswick Univ., Canada; Spray, J. G., New Brunswick Univ., Canada; Impact Cratering: Bridging the Gap Between Modeling and Observations; 2003, pp. 58; In English; Also announced as 20030014839; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

It is generally believed that the processes involved in the formation of an initial transient crater and its subsequent excavation, are common for all craters, regardless of their size. A critical assumption is that the depth/diameter ratio of a transient crater remains constant for any given crater size. The morphological diversity of impact structures is, therefore, attributed to the modification or collapse of an initial simple hemispherical transient crater. The mechanisms of impact crater collapse remain one of the least understood stages in the impact cratering process. Indeed, standard strength models used in conventional hydrocode modeling techniques are not successful in describing crater collapse. Numerical models have also rarely been constrained by field data from terrestrial impact structures. This is, however, a catch-22 situation because very few detailed field investigations of the tectonics of complex impact structures have been made. Here, we present new constraints on the formation of complex impact craters based on detailed field studies of the Houghton impact structure, Arctic Canada.

Author

*Transient Loads; Cratering; Collapse; Mathematical Models*

**20030014882** New Brunswick Univ., Planetary and Space Science Centre, Fredericton, New Brunswick Canada

**Impact Melting in Sedimentary Target Rocks?**

Osinski, G. R., New Brunswick Univ., Canada; Spray, J. G., New Brunswick Univ., Canada; Grieve, R. A. F., Natural Resources Canada, Canada; Impact Cratering: Bridging the Gap Between Modeling and Observations; 2003, pp. 59; In English; Also announced as 20030014839; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Sedimentary rocks are present in the target sequence of approx. 70% of the world's known impact structures. One of the outstanding questions in impact cratering studies is: do sedimentary rocks undergo impact melting? This question cannot be addressed through experimentation in the laboratory, which is limited to impact velocities generally below that required for wholesale melting. Numerical and computer-based modeling may offer some important information, however, as Pierazzo et al. note, "there is no good model for melt production from impact craters in sedimentary targets". Studies of naturally shocked rocks, therefore, offer the only true ground-truth data on the response of sedimentary rocks to impact. We have carried out detailed field and analytical studies of naturally shocked sedimentary rocks that will hopefully provide constraints for future modeling.

Author

*Impact Velocity; Melting; Mathematical Models; Targets; Sedimentary Rocks*

**20030014883** Geological Survey, Flagstaff, AZ USA

**Application of Gravity Data to Understanding Impact Mechanics**

Plescia, J. B., Geological Survey, USA; Impact Cratering: Bridging the Gap Between Modeling and Observations; 2003, pp. 60; In English; Also announced as 20030014839; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Gravity data provide important constraints on morphometry of impact structures and on the crustal response to the impact process. Such data can provide insight that may not be obtainable from surface geologic mapping and may not be quickly or cheaply obtained by other geophysical means. The gravity data can be used to constrain the dimensions of a completely to partly buried structure (e.g., diameter, central uplift, etc.) and can provide information on the subsurface character of both exposed and buried structures. Gravity data can also be used to reject some structures as being of impact origin.

Author

*Gravitation; Data Acquisition; Impact; Applications Programs (Computers)*

**20030014886** Brown Univ., Dept. of Geological Sciences, Providence, RI USA

**Atmospheric Effects and Oblique Impacts: Comparing Laboratory Experiments with Planetary Observations**

Schultz, Peter H., Brown Univ., USA; Impact Cratering: Bridging the Gap Between Modeling and Observations; 2003, pp. 63-64; In English; Also announced as 20030014839; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Without direct observations of a major impact, one of the few ways to study the impact process is by assessing the effects of its environment (gravity, atmosphere) or conditions of impact (e.g., impact angle). The purpose of this contribution is to review

selected consequences of both the atmosphere and impact angle as witnessed in laboratory experiments or revealed by large-scale craters preserved on different planets.

Author

*Atmospheric Effects; Oblique Shock Waves; Impact; Craters*

**20030014887** Alaska Univ., Geophysical Inst., Fairbanks, AK USA

**Excavation Flow and Central Peak Rings: Is There a Connection?**

Sharpton, V. L., Alaska Univ., USA; Dressler, B. O., Lunar and Planetary Inst., USA; Impact Cratering: Bridging the Gap Between Modeling and Observations; 2003, pp. 65-66; In English; Also announced as 20030014839; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

To approximate the conditions associated with the excavation stage of the impact process, many numerical simulations rely on some form of the Z-model, where the radial velocity of particles below the ground surface is given.

Derived from text

*Excavation; Impact Damage; Impact Acceleration; Impact Strength*

**20030014888** New Brunswick Univ., Planetary and Space Science Centre, Fredericton, New Brunswick Canada

**Mechanisms of In Situ Rock Displacement During Hypervelocity Impact: Field and Microscopic Observations**

Spray, J. G., New Brunswick Univ., Canada; Impact Cratering: Bridging the Gap Between Modeling and Observations; 2003, pp. 67; In English; Also announced as 20030014839; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The nature of rock deformation due to hypervelocity impact is discussed, especially with regard to the larger terrestrial structures (e.g., Sudbury, Vredefort, Manicouagan). Based on field observations and thin section microscopy, evidence is presented for two end-members of rock response to extreme strain rates: (1) bulk deformation, due to pervasive fracture generation and ensuing micro-displacement with melting; (2) localized large-displacement faulting, accompanied by friction melt generation (pseudotachylytes). There is no evidence for bulk "fluidization" at the thin section scale, except where bulk melting has occurred during impact melt sheet generation, wherein truly fluid (igneous) rocks are formed.

Derived from text

*Displacement; Rocks; Hypervelocity Impact; Impact Melts; Deformation*

**20030014889** Tokyo Univ., Hongo, Japan

**Toward a Complete Measurement of the Thermodynamic State of an Impact-Induced Vapor Cloud**

Sugita, Seiji, Tokyo Univ., Japan; Hamano, Keiko, Tokyo Univ., Japan; Kadono, Toshihiko, Japan Marine Science and Technology Center, Japan; Schultz, Peter H., Brown Univ., USA; Matsui, Takafumi, Tokyo Univ., Japan; Impact Cratering: Bridging the Gap Between Modeling and Observations; 2003, pp. 68; In English; Also announced as 20030014839; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Vaporization phenomena induced by hypervelocity impacts play an important role in the origin and evolution of Earth and other planets. There have been extensive research efforts made for understanding this process. However, the equation of state (EOS) and chemical reaction within high-pressure and high-temperature conditions of impact vapor are yet highly uncertain. This is primarily owing to the lack of experimental data on impact vapor cloud. Here we discuss newly developed spectroscopic methods to determine the thermodynamic state of impact-induced vapor very accurately.

Author

*Thermodynamics; Vaporizing; Vapors; Measurement; Impact Strength*

**20030015401** NASA Langley Research Center, Hampton, VA USA

**Airborne DIAL Ozone and Aerosol Trends Observed at High Latitudes Over North America from February to May 2000**

Hair, Jonathan W., NASA Langley Research Center, USA; Browell, Edward V., NASA Langley Research Center, USA; Butler, Carolyn F., Science Applications International Corp., USA; Grant, William B., NASA Langley Research Center, USA; DeYoung, Russell J., NASA Langley Research Center, USA; Fenn, Marta A., Science Applications International Corp., USA; Brackett, Vince G., Science Applications International Corp., USA; Clayton, Marian B., Science Applications International Corp., USA; Brasseur, Lorraine, Science Applications International Corp., USA; [2002]; 4p; In English; 21st International Laser Radar Conference, 8-12 Jul. 2002, Quebec, Canada; Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Distribution as joint owner in the copyright; Distribution as joint owner in the copyright

Ozone (O<sub>3</sub>) and aerosol scattering ratio profiles were obtained from airborne lidar measurements on thirty-eight aircraft flights over seven aircraft deployments covering the latitudes of 40 deg.-85 deg.N between 4 February and 23 May 2000 as part

of the TOPSE (Tropospheric Ozone Production about the Spring Equinox) field experiment. The remote and in situ O<sub>3</sub> measurements were used together to produce a vertically-continuous O<sub>3</sub> profile from near the surface to above the tropopause. Ozone, aerosol, and potential vorticity (PV) distributions were used together to identify the presence of pollution plumes and stratospheric intrusions. The number of observed pollution plumes was found to increase into the spring along with a significant increase in aerosol loading. Ozone was found to increase in the middle free troposphere (4-6 km) at high latitudes (60 deg.-85 deg. N) by an average of 4.3 ppbv/mo from about 55 ppbv in early February to over 72 ppbv in mid-May. The average aerosol scattering ratios in the same region increased at an average rate of 0.37/mo from about 0.35 to over 1.7. Ozone and aerosol scattering were highly correlated over entire field experiment. Based on the above results and the observed aircraft in-situ measurements, it was estimated that stratospherically-derived O<sub>3</sub> accounted for less than 20% of the observed increase in mid tropospheric O<sub>3</sub> at high latitudes. The primary cause of the observed O<sub>3</sub> increase was found to be the photochemical production of O<sub>3</sub> in pollution plumes.

Author

*Aerosols; North America; Ozone; Troposphere; Differential Absorption Lidar; Polar Regions*

**20030015739** Texas Univ., Geosciences Div., Dallas, TX USA

**Natural State Models of the Geysers Geothermal System *Final Report***

Brikowski, T.; Norton, D.; Blackwell, D.; Dec. 31, 2001; In English

Report No.(s): DE2002-791023; No Copyright; Avail: National Technical Information Service (NTIS)

Summarized in the following report are the results obtained in a project focused on natural state (pre-production) modeling of The Geysers geothermal system. The project was motivated by a need to better-understand the origin, current state, and future scenarios for The Geysers to allow better management of this unique energy resource. During the three-year course of the project nine reviewed papers were published, and six oral presentations made to communicate these results to the industrial and academic geothermal communities. Preprints of the papers are attached as appendices, and form the bulk of the material in this report.

NTIS

*Geysers; Geothermal Technology*

**20030015742** Lawrence Livermore National Lab., Livermore, CA USA

**Toward a New Era of Research in Aerosol/Cloud/CLimate Interactions at LLNL**

Chuang, C.; Dignon, J.; Grant, K.; Connell, P.; Bergman, D.; Sep. 27, 2000; In English; This document is color dependent and/or in landscape layout. It is currently available on CD-ROM

Report No.(s): DE2002-792712; UCRL-ID-140570; No Copyright; Avail: National Technical Information Service (NTIS)

One of the largest uncertainties in simulations of climate change over the industrial period is the impact of anthropogenic aerosols on the Earth's radiation budget. Much of this uncertainty arises from the limited capability for either precisely linking precursor gases to the formation and size distribution of the aerosols or quantitatively describing the existing levels of global aerosol loading. This project builds on our aerosol and chemistry expertise to address each of these uncertainties in a more quantitative fashion than is currently possible. With the current LDRD support, we are in the process to implement an aerosol microphysics module into our global chemistry model to more fundamentally and completely describe the processes that determine the distribution of atmospheric aerosols. Using this new modeling capability, in conjunction with the most current version of NCAR climate model, we will examine the influence of these processes on aerosol direct and indirect climate forcing.

NTIS

*Air Pollution; Atmospheric Chemistry; Climate Models; Cloud Physics*

**20030015780** Army Cold Regions Research and Engineering Lab., Hanover, NH USA

**Geologic Adaptation for Seismic Network Tracking**

Moran, Mark L.; Greenfield, Roy J.; Ketcham, Stephen A.; Oct. 2000; 13p; In English; Original contains color illustrations; See also ADM201471, Papers from the Meeting of the MSS Specialty Group on Battlefield Acoustic and Seismic Sensing, Magnetic and Electric Field Sensors (2001) Held in Applied Physics Lab, Johns Hopkins Univ, Laurel, MD on 24-26 Oct. 2001, volume 2

Report No.(s): AD-A409367; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We demonstrate a practical method for automatically adapting a network of seismic unattended UGSs to their specific geologic setting. The demonstration relies on data generated from high-fidelity 3D seismic simulations of a moving vehicle traversing a complex terrain having heterogeneous geology, and significant topographic relief. The simulated data, allows an arbitrary deployment of sensor nodes to form a network. Importantly, the simulated data shows realistic variations in character with as much as 40 dB of signal power variation between hard-rock materials and thick soils. The presence of large lateral geologic

contrasts also produces significant deflections in surface wave raypaths and extensive regions with very low surface wave spatial coherence. These conditions present notably difficult problems for UGS tracking methods.

DTIC

*Tracking (Position); Geology; Seismology*

**20030015810** Smithsonian Astrophysical Observatory, Cambridge, MA USA

**Satellite-Based Stratospheric and Tropospheric Measurements: Determination of Global Ozone and Other Trace Species Final Report, 1 Jan. 2001 - 30 Sep. 2002**

Chance, Kelly, Smithsonian Astrophysical Observatory, USA; February 2003; 12p; In English

Contract(s)/Grant(s): NAG5-10327; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This grant is an extension to our previous NASA Grant NAG5-3461, providing incremental funding to continue GOME (Global Ozone Monitoring Experiment) and SCIAMACHY (SCanning Imaging Absorption SpectroMeter for Atmospheric CHartographY) studies. This report summarizes research done under these grants through December 31, 2002. The research performed during this reporting period includes development and maintenance of scientific software for the GOME retrieval algorithms, consultation on operational software development for GOME, consultation and development for SCIAMACHY near-real-time (NRT) and off-line (OL) data products, and participation in initial SCIAMACHY validation studies. The Global Ozone Monitoring Experiment was successfully launched on the ERS-2 satellite on April 20, 1995, and remains working in normal fashion. SCIAMACHY was launched March 1, 2002 on the ESA Envisat satellite. Three GOME-2 instruments are now scheduled to fly on the Metop series of operational meteorological satellites (Eumetsat). K. Chance is a member of the reconstituted GOME Scientific Advisory Group, which will guide the GOME-2 program as well as the continuing ERS-2 GOME program.

Author

*Satellite-Borne Instruments; Ozonometry; Trace Elements; Environmental Monitoring; Spectrometers*

**20030016553** Kyushu Univ., Fukuoka, Japan

**Strength Characteristic of Cement Treated Soils and Environmental Impacts on Surrounding Water due to Underwater Casting**

Miyazaki, Yoshihiko, Kyushu Univ., Japan; Tang, YiXin, Kyushu Univ., Japan; Ochiai, Hidetoshi, Kyushu Univ., Japan; Yasufuku, Noriyuki, Kyushu Univ., Japan; Omine, Kiyoshi, Kyushu Univ., Japan; Technology Reports of Kyushu University; March 2001; ISSN 0023-2718; Volume 74, No. 2, pp. 99-106; In Japanese; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

In coastal projects, it is frequently required to cast cement mixed soils under water for various purposes. The situation of casting the treated soils under water becomes more difficult in comparison to that when doing above the water table. If the treated soils separate seriously under water, it is hardly to obtain the compressive strength as previously designed. Moreover, the underwater casting by improper method may bring about environmental impacts on the surrounding water. In order to investigate the material separation properties of cement mixed soils, a series of underwater casting experiments were conducted. It was found that the cement mixed soil showed a slight reduction in compressive strength, providing a cohesive soil was cast in a proper manner. Otherwise if the soil was roughly dropped under water, the compressive strength might greatly decrease to half of the strength as expected. Meanwhile, the increases of muddiness and pH observed in prototype experiment as well as in actual objects were much smaller than those measured in small scale experiments. Practical methods of casting cement mixed soils are explained, and it is showed that the so-called premixing method is the best way to provide high quality improved ground without significant environmental impacts.

Author

*Underwater Engineering; Sand Casting; Cements; Soils*

**20030016678** Geological Survey, Water Resources Div., Reston, VA USA

**Geohydrology and Numerical Simulation of Alternative Pumping Distributions and the Effects of Drought on the Ground-Water Flow System of Tinian, Commonwealth of the Northern Mariana Islands**

Gingerich, S. B.; 2002; 54p

Report No.(s): PB2003-101068; USGGS-WRI-02-4077; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The purpose of this report is to describe (1) the geologic and hydrologic setting of Tinian, (2) the numerical ground-water flow model developed, (3) the results of the model simulations that assess the hydrologic effects of drought on the freshwater lens, and (4) data needs. No new data were collected for this report; only existing data were used to develop the conceptual framework of the ground-water flow system. A numerical ground-water flow model of Tinian was used to refine the conceptual framework

and to estimate the effects of different withdrawal scenarios and drought on ground-water levels, the freshwater/saltwater interface, and coastal discharge.

NTIS

*Hydrology; Numerical Analysis; Drought; Ground Wave Propagation; Pumps*

**20030016683** Instituto Nacional de Pesquisas Espaciais, Sao Jose dos Campos, Brazil

**Estimating of the Soil Moisture in Brazil** *Estimativa da Capacidade de Armazenamento de Agua no Solo do Brasil*

Rossato, Luciana, Instituto Nacional de Pesquisas Espaciais, Brazil; 2002; 149p; In Portuguese; Original contains color illustrations

Report No.(s): INPE-8915/TDI/809; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

Soil moisture is a key variable in soil-atmosphere transfer processes. Soil moisture can be measured by direct and indirect techniques. Those methods are time consuming and impractical over large areas, such as Brazil. For this reason, soil moisture is generally estimated from the amount of water entering or draining from the soil profile by the water balance method. In this work, a soil water balance for Brazil was developed, using a new approximation that takes into account the spatial variability of soil characteristics. The water balance model used a simple equation, which is a function of the water availability, rainfall and potential evapotranspiration. The maximum soil water storage was derived from the field capacity and the wilting point using a pedo-transfer function (PTF). PTF allows the estimation of soil hydraulic properties from basic soil data, such as texture, organic carbon and bulk density. The evapotranspiration was estimated using the Penman-Monteith method. Based on the vegetation parameters provided by the SiB model, the potential evapotranspiration was calculated for the main Brazilian biomes, as defined in SiB. The mean soil moisture for the period 1971-1990 was derived combining historical rainfall data and evapotranspiration estimates. From the soil moisture climatology, regions with higher/lower soil moisture availability during El Nino (1982-1983)/La Nina (1988-1989) episodes were identified.

Author

*Evapotranspiration; Soil Moisture; Brazil; Climatology; Mathematical Models; Biosphere*

**20030016695** Geophysical Observatory, Sodankyla, Finland

**Ionospheric Convection in the Postnoon Auroral Oval: SuperDARN and Polar UVI Observations**

Kozlovsky, A., Geophysical Observatory, Finland; Koustov, A., SASKatchewan Univ., Canada; Lyatsky, W., Alabama Agricultural and Mechanical Univ., USA; Kangas, J., Geophysical Observatory, Finland; Parks, G., California Univ., USA; Chua, D., Washington Univ., USA; Sodankyla Geophysical Observatory Publications; Jul. 22, 2002; ISSN 1456-3673, No. 93; 28p; Repr. from Journal of Geophysical Research (UK), Jul. 2002 p 1-28; In English

Contract(s)/Grant(s): N00014-97-I-0267; NAG5-10202; Proj. 47918; Proj. 43988

Report No.(s): Paper-2002JA009261; ISBN 951-42-6029-5; Copyright; Avail: Issuing Activity

Super Dual Auroral Radar Network (SuperDARN) observations, ultraviolet imaging from the Polar satellite (UVI), and particle precipitation data from DMSP satellites have been used to investigate the electrodynamic of the postnoon auroral oval in the Northern hemisphere. We show that: (1) For negative IMF  $B_y$ , the convection reversal (CR) was co-located with the maximum of auroral luminosity, but during positive IMF  $B_y$  the convection reversal was poleward of the auroral oval up to several degrees in latitude; (2) Postnoon auroral oval was associated with a large-scale upward field-aligned current (FAC) of the order of  $6 \times 10^{10}$  (exp -7). A m(exp -2) in magnitude (the FAC was inferred from the SuperDARN and UVI data). For negative IMF  $B_y$ , maximum of the auroral intensity coincides in latitude with the maximum of the upward field-aligned current. However, for positive IMF  $B_y$  the maximum of the upward FAC was shifted to the poleward edge of the auroral oval; (3) In response to the IMF  $B_y$  turning from positive to negative, the maximum of the auroral luminosity did not change its position noticeably, but the position of the convection reversal changed considerably from 80-81 degs to about 76 degs MLAT, and the maximum of FAC moved from 77-78 degs to about 76 degs MLAT. Thus, after IMF  $B_y$  turns negative, both the FAC maximum and CR tend to coincide with the auroral maximum; (4) The IMF  $B_z$  positive deflection was followed by a decrease in both field-aligned current intensity and auroral luminosity. However, the decrease in the auroral luminosity lags behind the FAC decrease by about 12 min. Firstly, these observations allow us to suggest that the IMF  $B_y$ -related electric field can penetrate into the closed magnetosphere and produce convection and FAC changes in the region of the postnoon auroral oval. Secondly, we suggest that the interchange instability is a promising mechanism for the postnoon auroras.

Author

*Auroral Arcs; Satellite Observation; Ionospheric Heating; Electrodynamics; Auroral Absorption; Earth Magnetosphere; Field Aligned Currents; Ionospheric Currents*

**20030016696** Geophysical Observatory, Oulu Unit, Sodankyla, Finland

**Structure and Dynamics of the Magnetosphere Inferred from Radar and Optical Observations At High Latitudes, 1998-2002**

Kozlovsky, Alexander, Geophysical Observatory, Finland; Sodankyla Geophysical Observatory Publications; [2002]; ISSN 1456-3673, No. 93; 50p; In English; Sponsored in part by Vilho, Yrjoe and Kalle Vaeisaelae Foundation

Contract(s)/Grant(s): Proj. 46328; Proj. 47918; Proj. 43988; ISBN 951-42-6029-5; Copyright; Avail: Issuing Activity

Optical auroral observations combined with radar measurements were interpreted in terms of the source mechanisms of the magnetospheric convection and field-aligned currents and physical mechanisms of the auroral arcs. Relative motion of nightside auroral arcs with respect to the ambient plasma has shown that variations in the arc velocity lag behind corresponding variations in the ionospheric plasma drift velocity by 5 - 9 minutes. These observations indicate that the dawn-dusk electric potential difference arises at the open polar cap magnetic field lines due to the solar wind - magnetosphere interaction and then propagates to the closed magnetotail field lines through the ionosphere. A new type of noon poleward moving high-latitude auroral arcs (PMAA) was described, which shows essential differences from well-known PMAFs associated with reconnection and FTEs. The arcs arise at the closed magnetic field lines, are associated with strong convection disturbances, and propagate poleward at the velocity, which does not show any dependence on the ionospheric plasma convection along the same direction. We suggest that the field line resonance model is most promising to explain the origin of the PMAA. In the post-noon auroral ionosphere, a characteristic picture of spatial variations across the auroral oval is obtained for the horizontal and vertical plasma flows, field-aligned currents, and height profiles of the ionospheric plasma parameters (density and temperatures). Response of the postnoon high-latitude magnetosphere to the IMF changes has shown that: (1) Southward turnings of the interplanetary magnetic field were associated with bright afternoon auroral oval moving equatorward. The equatorward motion started 27 +/- 7 min after the IMF Bz turned southward at the subsolar point; (2) The IMF Bz northward deflection was followed by a decrease in both field-aligned current intensity and auroral luminosity. The decrease in the auroral luminosity lags behind the field-aligned current decrease by about 12 min; (3) In response to the IMF by turning from positive to negative values, maximum of the auroral luminosity does not change its position, whereas the convection reversal moves considerably. This observation allows us to suggest that the IMF By-related electric field can penetrate into the closed magnetosphere and produce convection changes in the region of the postnoon auroral oval.

Author

*Solar Wind; Solar Terrestrial Interactions; Earth Magnetosphere; Magnetic Disturbances; Auroral Arcs; Radar Astronomy; Polar Regions*

**20030016697** Geophysical Observatory, Sodankyla, Finland

**Motion and Origin of Noon High-Latitude Poleward Moving Auroral Arcs on Closed Magnetic Field Lines**

Kozlovsky, Alexander, Geophysical Observatory, Finland; Kangas, Jorma, Geophysical Observatory, Finland; Sodankyla Geophysical Observatory Publications; 2002; ISSN 1456-3673, No. 93; 16p; Repr. from Journal of Geophysical Research (UK), v. 107, no. A2, 2002 p 1-13; In English

Contract(s)/Grant(s): Proj. 47918

Report No.(s): Paper-2001JA900145; ISBN 951-42-6029-5; Copyright; Avail: Issuing Activity

We present observations of the near-noon high-latitude poleward moving auroral arcs, which show essential differences from well-known poleward moving auroral forms associated with reconnection and flux transfer events. We suggest that the observed arcs are a specific class of dayside auroras referred to in the paper as poleward moving auroral arcs. The arcs were investigated together with the ionospheric plasma flows derived from the European Incoherent Scatter VHF measurements over Svalbard. The auroral arc motion was monitored at 1000 - 1300 magnetic local time by the all-sky camera on 9 December 1998. It has been found that the noon auroral arcs move poleward at the velocity of the order of 150-350 m s (exp 1), and this velocity does not show any dependence on the velocity of the ionospheric plasma convection along the same direction. The arcs appear at 10-20 min after strong changes (up to 3 km s(exp 1)) in the east-west plasma flow, which resulted from variations in the interplanetary magnetic field. Ionospheric plasma drift and ground magnetometer data show the location of the auroras equatorward of the convection reversal. Spectrums of the northward electric field variations measured by the radar demonstrate clear peaks corresponding to the magnetic field line eigenfrequency oscillations with amplitude on the order of 10 mV m. The period of the oscillations increases from 7 min at 74.3 deg magnetic latitude (MLAT) to 14 min at 76.4 deg MLAT, and corresponding spectral characteristics were observed in the magnetic field measured on the ground. The observed features allow us to suggest that the noon auroral arcs arise on closed magnetic field lines as a result of interference between Alfvén field line eigenmode toroidal oscillations on different

L shells. The field line resonance oscillations at the near-cusp L shells are excited by the Alfvén impulse associated with the convection disturbance following after variations in interplanetary parameters.

Author

*Auroral Arcs; Boundary Layers; Magnetic Fields; Magnetohydrodynamic Flow; Magnetohydrodynamic Waves; Solar Convection (Astronomy); Plasma Physics*

**20030016698** Geophysical Observatory, Sodankyla, Finland

**Characteristics of the Postnoon Auroras Inferred from EISCAT Radar Measurements**

Kozlovsky, A., Geophysical Observatory, Finland; Kangas, J., Geophysical Observatory, Finland; Sodankyla Geophysical Observatory Publications; Feb. 01, 2001; ISSN 1456-3673, No. 93; 18p; Repr. from Journal of Geophysical Research (UK), v. 106, no. A2, Feb. 2002 p 1817-1834; In English

Contract(s)/Grant(s): Proj. 46328

Report No.(s): Paper-2000JA900113; ISBN 951-42-6029-5; Copyright; Avail: Issuing Activity

Svalbard European Incoherent Scatter (EISCAT) radar and Polar satellite ultraviolet imager data have been used to investigate structure and dynamics of the postnoon auroral oval (in the so-called '14 MLT' region). Southward turnings of the interplanetary magnetic field were associated with bright afternoon and evening arcs which drifted equatorward. Increase in the equatorward arc velocity occurred about 27 +/- 7 min after the IMF Bz turned southward at the subsolar point. The observed equatorward motion may occur independently of the convection: In one of the cases, the velocity of the drifting arc was observed to be about 100 - 200 m/s southward whereas the ionospheric plasma drifted northward at a velocity of 160 m/s. The arcs were located in the region of convection shear that was shown by the ground magnetometers and the EISCAT data on ion velocity and temperature. In the cases when electric field data were available the meridional component of the electric field varied from about -60 mV/m (southward) equatorward of the arc to +30 mV/m (northward) poleward of the arc. Ionospheric plasma parameters were measured during the passes of the arcs through the radar beam. Downward field-aligned ion flow at the 300 - 550 km altitude was observed poleward of the arc, whereas upward flows were observed equatorward of the arc. This variation is explained by the difference in the vertical gradient of plasma density. Convection flows associated with arc, and differences in electron precipitation and sun-light conditions create the vertical gradients of plasma density that determine the ambipolar diffusion and observed ion motion.

Author

*Auroral Arcs; Interplanetary Magnetic Fields; Magnetic Disturbances; Auroral Ionization; Auroral Zones; Position (Location); Convective Flow*

**20030016699** Geophysical Observatory, Sodankyla, Finland

**Response of the Quiet Auroral Arc Motion to Ionospheric Convection Variations**

Kozlovsky, A., Geophysical Observatory, Finland; Lakkala, T., Geophysical Observatory, Finland; Kangas, J., Geophysical Observatory, Finland; Aikio, A., Geophysical Observatory, Finland; Sodankyla Geophysical Observatory Publications; Oct. 01, 2001; ISSN 1456-3673, No. 93; 12p; Repr. from Journal of Geophysical Research (UK), v. 106, no. A10, Oct. 2001 p 21,463-21,473; In English

Contract(s)/Grant(s): Proj. 46328; ISBN 951-42-6029-5; Copyright; Avail: Issuing Activity

Equatorward motion of quiet auroral arcs was studied together with the F region ionospheric plasma drift observed by the European Incoherent Scatter radar in Tromsø. Variations in the arc velocity lagged behind corresponding variations in the ionospheric convection velocity by 5-9 min. The same result was obtained from comparison of the arc velocity with variations in the eastward component of ground magnetic field. The variations in the arc and plasma drift velocities followed interplanetary magnetic field Bz variations. The observations indicate that the dawn-dusk electric potential difference arises at the open polar cap magnetic field lines due to the solar wind - magnetosphere interaction and then propagates to the closed magnetotail field lines through the ionosphere.

Author

*Solar Wind; Interplanetary Magnetic Fields; Auroral Arcs; Polar Regions; Solar Terrestrial Interactions; Earth Magnetosphere; Magnetic Disturbances; Velocity Measurement*

**20030016717** Chinese Inst. of Engineers, Taipei Taiwan, Province of China

**Journal of the Chinese Institute of Engineers. Special Issue: Commemoration of Chi-Chi Earthquake (II), Volume 25**

Sep. 2002; 148p; In English

Report No.(s): PB2003-101751; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

Contents include the following: Deep Electromagnetic Images of Seismogenic Zone of the Chi-Chi (Taiwan) Earthquake; New Techniques for Stress-Forecasting Earthquakes; Aspects of Characteristics of Near-Fault Ground Motions of the 1999 Chi-Chi (Taiwan) Earthquake; Liquefaction Damage and Related Remediation in Wufeng after the Chi-Chi Earthquake; Fines Content Effects on Liquefaction Potential Evaluation for Sites Liquefied during Chi-Chi Earthquake 1999; Damage Investigation and Liquefaction Potential Analysis of Gravelly Soil; Dynamic Characteristics of Soils in Yuan-Lin Liquefaction Area; A Preliminary Study of Earthquake Building Damage and Life Loss Due to the Chi-Chi Earthquake; Statistical Analyses of Relation between Mortality and Building Type in the 1999 Chi-Chi Earthquake; Development of an After Earthquake Disaster Shelter Evaluation Model; Posttraumatic Stress Reactions in Children and Adolescents One Year after the 1999 Taiwan Chi-Chi Earthquake; Changes or Not is the Question: the Meaning of Posttraumatic Stress Reactions One Year after the Taiwan Chi-Chi Earthquake.

NTIS

*Earthquakes; Earthquake Damage; Statistical Analysis; Dynamic Characteristics; Human Beings*

**20030017775** NASA Goddard Space Flight Center, Greenbelt, MD USA

**Prospects for Improved Forecasts of Weather and Short-Term Climate Variability on Subseasonal (2-Week to 2-Month) Times Scales**

Schubert, Siegfried, NASA Goddard Space Flight Center, USA; Dole, Randall, National Oceanic and Atmospheric Administration, USA; vandenDool, Huug, National Oceanic and Atmospheric Administration, USA; Suarez, Max, NASA Goddard Space Flight Center, USA; Waliser, Duane, State Univ. of New York, USA; November 2002; 163p; In English, 16-18 Apr. 2002, Greenbelt, MD, USA; Sponsored by NASA Goddard Space Flight Center, USA; Also announced as 20030017776 through 20030017821; Original contains color illustrations

Report No.(s): NASA/TM-2002-104606/VOL23; NAS 1.15:104606/VOL23; Rept-2002-005438-0/VOL23; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

This workshop, held in April 2002, brought together various Earth Sciences experts to focus on the subseasonal prediction problem. While substantial advances have occurred over the last few decades in both weather and seasonal prediction, progress in improving predictions on these intermediate time scales (time scales ranging from about two weeks to two months) has been slow. The goals of the workshop were to get an assessment of the "state of the art" in predictive skill on these time scales, to determine the potential sources of "untapped" predictive skill, and to make recommendations for a course of action that will accelerate progress in this area. One of the key conclusions of the workshop was that there is compelling evidence for predictability at forecast lead times substantially longer than two weeks. Tropical diabatic heating and soil wetness were singled out as particularly important processes affecting predictability on these time scales. Predictability was also linked to various low-frequency atmospheric "phenomena" such as the annular modes in high latitudes (including their connections to the stratosphere), the Pacific/North American (PNA) pattern, and the Madden Julian Oscillation (MJO). The latter, in particular, was highlighted as a key source of untapped predictability in the tropics and subtropics, including the Asian and Australian monsoon regions.

Author

*Earth Sciences; Weather Forecasting; Climate; Variability*

**20030018101** Smithsonian Astrophysical Observatory, Cambridge, MA USA

**Energetic Metastable Oxygen and Nitrogen Atoms in the Terrestrial Atmosphere *Annual Report, 15 Mar. 2002 -14 Mar. 2003***

Kharchenko, Vasili, Smithsonian Astrophysical Observatory, USA; January 2003; 2p; In English

Contract(s)/Grant(s): NAG5-11857; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

We have investigated the energy distributions of the metastable oxygen atoms in the terrestrial thermosphere. Nascent O(1D) atoms play a fundamental role in the energy balance and chemistry of the terrestrial atmosphere, because they are produced by photo-chemical reactions in the excited electronic states and carry significant translational energies.

Derived from text

*Metastable Atoms; Energy Distribution; Nitrogen Atoms; Oxygen Atoms*

**20030018103** Space Physics Research Inst., Sunnyvale, CA USA

**Investigation of Dynamic and Physical Processes in the Upper Troposphere and Lower Stratosphere *Final Report, 1 Apr. 1999 - 31 Jul. 2002***

Selkirk, Henry B., Space Physics Research Inst., USA; [2002]; 6p; In English

Contract(s)/Grant(s): NCC2-1113; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Research under this Cooperative Agreement has been funded by several NASA Earth Science programs: the Atmospheric Effects of Radiation Program (AEAP), the Upper Atmospheric Research Program (UARP), and most recently the Atmospheric Chemistry and Modeling Assessment Program (ACMAP). The purpose of the AEAP was to understand the impact of the present and future fleets of conventional jet traffic on the upper troposphere and lower stratosphere, while complementary airborne observations under UARP seek to understand the complex interactions of dynamical and chemical processes that affect the ozone layer. The ACPMAP is a more general program of modeling and data analysis in the general area of atmospheric chemistry and dynamics, and the Radiation Sciences program.

Derived from text

*Troposphere; Stratosphere; Atmospheric Chemistry; Atmospheric Effects; Chemical Reactions*

## 47

### METEOROLOGY AND CLIMATOLOGY

*Includes weather observation forecasting and modification*

**20030014778** Oregon State Univ., Coll. of Oceanic and Atmospheric Sciences, Corvallis, OR USA

**Limits to Susceptibility Final Report, 1 Oct. 1998 - 30 Sep. 2002**

Coakley, James A., Jr., Oregon State Univ., USA; Feb. 14, 2002; 6p; In English

Contract(s)/Grant(s): NAG5-7686

Report No.(s): NS080A; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

1-kilometer AVHRR observations of ship tracks in low-level clouds off the west coast of the U.S. were used to determine limits for the degree to which clouds might be altered by increases in anthropogenic aerosols. Hundreds of tracks were analyzed to determine whether the changes in droplet radii, visible optical depths, and cloud top altitudes that result from the influx of particles from underlying ships were consistent with expectations based on simple models for the indirect effect of aerosols. The models predict substantial increases in sunlight reflected by polluted clouds due to the increases in droplet numbers and cloud liquid water that result from the elevated particle concentrations. Contrary to the model predictions, the analysis of ship tracks revealed a 15-20% reduction in liquid water for the polluted clouds. Studies performed with a large-eddy cloud simulation model suggested that the shortfall in cloud liquid water found in the satellite observations might be attributed to the restriction that the 1-kilometer pixels be completely covered by either polluted or unpolluted cloud. The simulation model revealed that a substantial fraction of the indirect effect is caused by a horizontal redistribution of cloud water in the polluted clouds. Cloud-free gaps in polluted clouds fill in with cloud water while the cloud-free gaps in the surrounding unpolluted clouds remain cloud-free. By limiting the analysis to only overcast pixels, the current study failed to account for the gap-filling predicted by the simulation model. This finding and an analysis of the spatial variability of marine stratus suggest new ways to analyze ship tracks to determine the limit to which particle pollution will alter the amount of sunlight reflected by clouds.

Author

*Advanced Very High Resolution Radiometer; Atmospheric Models; Cloud Cover; Clouds (Meteorology); Aerosols; NOAA Satellites; Computerized Simulation*

**20030015245** Instituto Nacional de Pesquisas Espaciais, Sao Jose dos Campos, Brazil

**Physical Initialization in Weather Prediction Models and Study of Its Effects on the Energy Partition in the Vertical and Horizontal Modes over the Tropics and South America Inicializacao Fisica em Modelos de Previsao de Tempo e Estudo de Seus Efeitos na Particao de Energia em Modos Verticais e Horizontais nos Tropicos e na America do Sul**

Nunes, Ana Maria Bueno, Instituto Nacional de Pesquisas Espaciais, Brazil; 2002; 224p; In Portuguese

Report No.(s): INPE-9359-TDI/821; No Copyright; Avail: CASI; A10, Hardcopy; A03, Microfiche

Physical initialization was developed at The Florida State University to improve rainfall forecast over tropical region by numerical weather prediction models. In this initialization procedure, observed rainfall rates are assimilated using reverse cumulus algorithms and nudging. At the end of the assimilation period - usually 24 hours - the model will be able to reproduce the proper rainfall rates. The ability of the FSU regional spectral model to assimilate high resolution rainfall data over Brazil will be focused in this work. Since the FSU global spectral model was used as a base field (i.e. boundary) for the regional model, the impact of initialization of the global model on the regional model's ability to assimilate rainfall is also examined. Physical initialization was also included in a version of the Center for Ocean-Land-Atmosphere Studies Global Spectral Model used by the Center for Weather Prediction and Climate Studies in Brazil. The 24-hour accumulated precipitation predicted fields from the physically initialized conditions show improved correlations with the Special Sensor Microwave/Imager-Outgoing Longwave Radiation estimates in FSU regional and CPTEC global models. A study of physical initialization effects on the normal mode

vertical and horizontal structures showed that mixed Rossby-gravity mode, and eastward and westward propagating gravity modes with complex vertical structures, which have smaller equivalent depths, increase their total energy by the influence of physical initialization. On the other hand, the percentage of total energy in the vertical modes related to the convection - with larger equivalent depths - is decreased in the mixed Rossby-gravity mode, and in the two gravity ~nodes due to physical initialization. During the Southern Hemisphere summer, westward gravity mode interaction with Rossby mode as well as Kelvin mode contribute positively to the total energy in the region of the South Atlantic Convergence Zone.

Author

*Algorithms; Atmospheric Models; Climate; Numerical Weather Forecasting*

**20030015397** NASA Langley Research Center, Hampton, VA USA

**Numerical Simulation of a Convective Turbulence Encounter**

Proctor, Fred H., NASA Langley Research Center, USA; Hamilton, David W., NASA Langley Research Center, USA; Bowles, Roland L., AeroTech Research, Inc., USA; [2002]; 5p; In English; 10th Conference on Aviation, Range and Aerospace Meteorology, 13-16 May 2002, Portland, OR, USA; Sponsored by American Meteorological Society, USA; Original contains color illustrations

Contract(s)/Grant(s): NAS1-99074; Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Distribution as joint owner in the copyright; Distribution as joint owner in the copyright

A numerical simulation of a convective turbulence event is investigated and compared with observational data. The numerical results show severe turbulence of similar scale and intensity to that encountered during the test flight. This turbulence is associated with buoyant plumes that penetrate the upper-level thunderstorm outflow. The simulated radar reflectivity compares well with that obtained from the aircraft's onboard radar. Resolved scales of motion as small as 50 m are needed in order to accurately diagnose aircraft normal load accelerations. Given this requirement, realistic turbulence fields may be created by merging subgrid-scales of turbulence to a convective-cloud simulation. A hazard algorithm for use with model data sets is demonstrated. The algorithm diagnoses the RMS normal loads from second moments of the vertical velocity field and is independent of aircraft motion.

Derived from text

*Turbulence; Numerical Analysis; Mathematical Models; Convection Clouds; Simulation*

**20030015409** ENSCO, Inc., Cocoa Beach, FL USA

**Land-Breeze Forecasting Final Report, 1995-2001**

Case, Jonathan L., ENSCO, Inc., USA; Wheeler, Mark M., ENSCO, Inc., USA; December 2002; 72p; In English

Contract(s)/Grant(s): NAS10-01052

Report No.(s): NASA/CR-2002-211181; NAS 1.26:211181; Rept-02-003; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The nocturnal land breeze at the Kennedy Space Center (KSC) and Cape Canaveral Air Force Station (CCAFS) is both operationally significant and challenging to forecast. The occurrence and timing of land breezes impact low-level winds, atmospheric stability, low temperatures, and fog development. Accurate predictions of the land breeze are critical for toxic material dispersion forecasts associated with space launch missions, since wind direction and low-level stability can change noticeably with the onset of a land breeze. This report presents a seven-year observational study of land breezes over east-central Florida from 1995 to 2001. This comprehensive analysis was enabled by the high-resolution tower observations over KSC/CCAFS. Five-minute observations of winds, temperature, and moisture along with 9 15-MHz Doppler Radar Wind Profiler data were used to analyze specific land-breeze cases, while the tower data were used to construct a composite climatology. Utilities derived from this climatology were developed to assist forecasters in determining the land-breeze occurrence, timing, and movement based on predicted meteorological conditions.

Author

*Weather Forecasting; Wind (Meteorology); Climatology; Applications Programs (Computers); Prediction Analysis Techniques; Meteorological Parameters*

**20030015490** NASA Glenn Research Center, Cleveland, OH USA

**A Downturn of the Strong Winter-Warming Trend In Europe**

Otterman, Joseph, NASA Glenn Research Center, USA; Atlas, Robert, NASA Glenn Research Center, USA; Bungato, Dennis, Science Applications International Corp., USA; Koslowsky, Dirk, Berlin Free Univ., Germany; Wos, Alojzy, Mickiewicz (Adam) Univ., Poland; [2002]; 23p; In English; Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche; Distribution as joint owner in the copyright; Distribution as joint owner in the copyright

Surface-air temperatures measured in winter at 3 meteorological stations in central Europe rise substantially for most of the second-half of the 20th century. This means shorter winter, and longer growing season, which has positive implications for regional agriculture. However, these positive trends stopped in winter of 1996, and for the recent 7 years no further climatic amelioration is reported.

Author

*Temperature Measurement; Atmospheric Temperature; Climatology*

**20030015754** NASA Langley Research Center, Hampton, VA USA

**Convectively Induced Turbulence Encountered During NASA's Fall-2000 Flight Experiments**

Hamilton, David W., NASA Langley Research Center, USA; Proctor, Fred H., NASA Langley Research Center, USA; [2002], Paper 10.8, pp. 371-374; In English; 10th Conference on Aviation, Range and Aerospace Meteorology, 13-16 May 2002, Portland, OR, USA; Sponsored by American Meteorological Society, USA; Original contains color illustrations; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Aircraft encounters with atmospheric turbulence are a leading cause of in-flight injuries aboard commercial airliners and cost the airlines millions of dollars each year. Most of these injuries are due to encounters with turbulence in and around convection. In a recent study of 44 turbulence accident reports between 1990 and 1996, 82% of the cases were found to be near or within convective activity (Kaplan et al. 1999). According to NTSB accident reports, pilots' descriptions of these turbulence encounters include 'abrupt', 'in Instrument Meteorological Conditions (IMC)', 'saw nothing on the weather radar', and 'the encounter occurred while deviating around' convective activity. Though the FAA has provided guidelines for aircraft operating in convective environments, turbulence detection capability could decrease the number of injuries by alerting pilots of a potential encounter. The National Aeronautics and Space Administration, through its Aviation Safety Program, is addressing turbulence hazards through research, flight experiments, and data analysis. Primary focus of this program element is the characterization of turbulence and its environment, as well as the development and testing of hazard estimation algorithms for both radar and in situ detection. The ultimate goal is to operationally test sensors that will provide ample warning prior to hazardous turbulence encounters. In order to collect data for support of these activities, NASA-Langley's B-757 research aircraft was directed into regions favorable for convectively induced turbulence (CIT). On these flights, the airborne predictive wind shear (PWS) radar, augmented with algorithms designed for turbulence detection, was operated in real time to test this capability. In this paper, we present the results of two research flights when turbulence was encountered. Described is an overview of the flights, the general radar performance, and details of four encounters with severe turbulence.

Author

*Atmospheric Turbulence; Aircraft Safety; Flight Tests; Weather Forecasting; Meteorological Radar; Thunderstorms; Convection Clouds*

**20030016090** Meteorological Satellite Center, Kiyose, Japan

**Monthly Report of Meteorological Satellite Center: October 2002**

October 2002; In English; In Japanese; The CD-ROM conforms to the ISO 9660 standard for volume and file structure; Document files and Satellite observation data are recorded in either in ASCII or shift JIS code; Full Disk Earth's Cloud Images are recored in Bit-Map (BMP) format; Copyright; Avail: Issuing Activity

This CD-ROM concerns the Monthly Report of the Meteorological Satellite Center (MSC). It Contains the observation data derived from the Geostationary Meteorological Satellite (GMS) of Japan and the polar orbital meteorological satellites operated by NOAA (National Oceanographic and Atmospheric Administration). The CD-ROM contains following observation data: Full Disk Earth's Cloud, Cloud Image of Japan and its Vicinity, Cloud Amount, Sea Surface Temperature, Cloud Motion Wind, Water Vapor Motion Wind, Equivalent Blackbody Temperature, OLR (Out-going Longwave Radiation), Solar Irradiation, Snow and Ice Index, Orbit Data, Attitude Data, VISSR (Visible Infrared Spin Scan Radiometer) Image Data Catalog, (Cartridge Magnetic Tape (CMT), Micro Film), TOVS (TIROS (Television and Infrared Observation Satellite) Operational Vertical Sounder) Vertical Profile of Temperature and Precipitable Water, TOVS Total Ozone Amount. Although this user's guide is revised yearly, it may happen that a change of contents of the Monthly Report is not reflected in the user's guide, if the change is carried out between revisions of the user's guide. The latest contents of the Monthly Report and the detailed information of the contents are described in document files which are contained in the CD-ROM. Please read the document files.

Author

*CD-ROM; Geosynchronous Orbits; Japan; Meteorological Satellites*

**20030016547** Instituto Nacional de Pesquisas Espaciais, Sao Jose dos Campos, Brazil

**Winds in the 80-100 km Range Height over Cachoeira Paulista (22, 70 deg S; 45 deg W) Measured by Meteor Radar *Ventos na Regiao de 80-100 KM de Altura Sobre Cachoeira Paulista (22,7 deg W) Medidos por Radar Meteorico***

Tokumoto, Aparecido Seigim, Instituto Nacional de Pesquisas Espaciais, Brazil; 2002; 138p; In Portuguese; Original contains color illustrations

Report No.(s): INPE-9126-TDI/815; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

The dynamics between 80 and 100 km range height over Cachoeira Paulista (22,70 N; 450 W) has been investigated using the first two-year winds measurements collected by the meteor radar SKiYMET installed at this place since March, 1999. This system uses the interferometric technique for seeing meteors over the whole sky and through appropriate algorithms it can determine the wind values in the mesosphere and lower thermosphere. The winds presented in this work were measured between March, 1999 and February, 2001 and were separated into mean and tidal components. Mean winds were compared with the HWM-93 model and the atmospheric tides were compared with the GSWM00 model. The results indicate a mixture of characteristics of equatorial and middle latitude region. The zonal mean winds show variability semiannual between 80 and 90 km range height, typical of equatorial regions and annual variability between 90 and 100 km, typical of middle latitude. The atmospheric tides also present common characteristics of equatorial and middle latitude regions, with the dominance of the (1,1) mode in the diurnal tide, typical of equatorial latitudes, but with a strong influence of higher and non propagating modes, typical of middle latitudes, specially above 90 km, mainly during November and December. The semidiurnal tide has low amplitude below 90 km, but it becomes important above 90 km.

Author

*Wind Measurement; Interferometry; Radar Measurement; Atmospheric Tides*

**20030016566** Instituto Nacional de Pesquisas Espaciais, Sao Jose dos Campos, Brazil

**Constructing Digital Elevation Models for Watersheds with Kriging *Modelos Digitais de Elevacao de Microbacias Elaborados com Krigagem***

deMorissonValeriano, Marcio, Instituto Nacional de Pesquisas Espaciais, Brazil; [2002]; 50p; In Portuguese; Original contains color illustrations

Report No.(s): INPE-9364-RPQ/736; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This research was conducted to evaluate kriging as a method for the generation of Digital Elevation Models (DEM) for watershed studies. The points stored by the digitizing of the contour lines were submitted to sampling, geostatistical analyses and interpolation procedures, in a non-linear data flux. The evaluation of the results were concerned to the elevation itself and to the slope angles, calculated by Geographical Information System (GIS), as compared to those obtained from DEM created through Emu interpolation and Inverse Squared Distance (ISD) methods. Among 6 watersheds with different relief types and cartographical data specifications, kriged DEM showed flexibility to yield relatively adequate representations of the local variations of the different areas, with round and harmonic features, as well as abrupt ten-am changes. Visual observations of the surfaces and of relief profiles, and analyses of slope results histograms led to the conclusion that linear and ISD interpolators, despite their popularity, bring serious limitations to the use of the corresponding DEM for the quantitative analysis of watershed topographical data.

Author

*Visual Observation; Quantitative Analysis; Kriging; Information Systems; Digital Elevation Models; Watersheds*

**20030016706** Lawrence Livermore National Lab., Livermore, CA USA

**Comparison of Atmospheric Water Vapor in Observational and Model Data Sets**

Boyle, J. S.; Mar. 01, 2000; 50p; In English

Report No.(s): DE2002-792757; UCRL-ID-138187; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The distribution of water vapor in the atmosphere in a real sense is what makes weather and climate. Water vapor is the most active greenhouse gas and through feedbacks exerts a powerful influence on the climate system. Details of the distribution are undergoing even closer examination in the context of global warming studies. In order to assess the magnitudes and nature of the vapor feedbacks the distribution both horizontally and vertically must be known to a fairly high degree of accuracy, more accurately than it is now known. This paper compares the monthly mean water vapor content in five global, observationally based data sets and three integrations of the NCAR Community Climate Model 3/Climate System Model (CCM3/CSM). Differences in the observational data sets provide a context in which to evaluate the products of the GCM integrations.

NTIS

*Water Vapor; Atmospheric Composition; Aeronomy; Climate Models; Atmospheric Moisture*

20030016716 Lawrence Livermore National Lab., Livermore, CA USA

**Comparison of Variability of the Monthly Mean Temperature of the ECMWF and NCEP Reanalyses and CCM3 and CSM Simulations**

Boyle, J. S.; Feb. 23, 2000; 44p; In English

Report No.(s): DE2002-792558; UCRL-ID-137580; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The low frequency variation in the three dimensional air temperature fields of two reanalyses and two model simulations are described. The data sets used are the monthly mean temperature fields for the NCAR Climate Simulation Model (CSM, Boyle and Gent, 1998) 300 year run, a NCAR Community Climate Model version 3. (CCM3, Kiehl et al., 1998) AMIP type simulation, and the NCEP/NCAR and ECMWF (ERA) reanalysis data sets. The variances and correlations are computed for the anomalies from the annual cycle for each data set. In general the reanalyses and models agree fairly well on the structure of the temperature variance. The models tend to have too much variance at the surface compared to the reanalyses. The CSMs poor simulation of the SST in the eastern Pacific leads to a much reduced variance in the Nino3 region. The enhanced variability over land appears to affect the midlatitude simulation of the CSM in that the higher surface variability extends off the east coast of continents. This is not evident in CCM3 and reanalyses where the SSTs are prescribed.

NTIS

*Climate Models; Computerized Simulation; Weather Forecasting; Temperature Distribution*

20030017776 Maryland Univ., College Park, MD USA

**Some Opportunities in Dynamic: Extended Range Forecasting**

Kalnay, Eugenia, Maryland Univ., USA; Cai, Ming, Maryland Univ., USA; Pena, Malaquias, Maryland Univ., USA; Prospects for Improved Forecasts of Weather and Short-Term Climate Variability on Subseasonal (2-Week to 2-Month) Times Scales; November 2002; Volume 23, pp. 43-44; In English; Also announced as 20030017775; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

Extracting useful predictability from the Dynamic Extended Range Forecasting (DERF) time range, two weeks to two months, is not easy. D. Burridge (pers. comm.) referred to this forecast range as the "dry patch of predictability", meaning that it is too long for weather forecasting from information in the initial conditions, and too short for influences such as ENSO forcing to set in and provide predictability from boundary conditions. Nevertheless, it should be both economically very important and scientifically possible to advance significantly beyond what we are doing today. In this talk we review some of the opportunities that we believe have not yet been exploited within the DERF "dry patch".

Derived from text

*Weather Forecasting; Variability; Temperate Regions; Predictions; Dynamic Range; Atmospheric Models*

20030017777 National Oceanic and Atmospheric Administration, Climate Prediction Center, Camp Springs, MD USA

**CPC Operational Methods and Skill in the Day 15 - Day 60 Forecast Range**

vandenDool, Huug, National Oceanic and Atmospheric Administration, USA; Prospects for Improved Forecasts of Weather and Short-Term Climate Variability on Subseasonal (2-Week to 2-Month) Times Scales; November 2002; Volume 23, pp. 47-50; In English; Also announced as 20030017775; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

The Climate Prediction Center has only one operational forecast in the day 15 - day 60 range, which is, as predicted by Von Neumann(1955), the most difficult of all ranges. We do publish a forecast for monthly mean conditions over the US at a lead of 2 weeks. This forecast has been released once a month since Dec 1994. We will discuss briefly the tools underlying this forecast, in particular OCN (optimal climate normals), CCA (canonical correlation analysis), ENSO composites (when applicable) and, during summer, local and non-local soil moisture tools such as the Constructed Analogue. The weight given to the NCEP two tiered 'coupled' model is rather low so far. Relying on a-priori skill estimates over an historical evaluation period, the tools are combined each month into an official forecast. We present here a discussion of the skill of these official monthly forecasts for 1995-present. A comparison to the skill of the seasonal forecast shows that CPC's monthly forecast is basically a watered down version of the seasonal forecast, but with somewhat lower signal to noise ratio, as expected. Much of the forecast map shows the dreaded CL, a forecast for equal chances.

Derived from text

*Forecasting; Soil Moisture; Predictions; Climate*

**20030017778** European Centre for Medium-Range Weather Forecasts, Reading, UK

**Monthly Forecasting At ECMWF**

Vitart, Frederic, European Centre for Medium-Range Weather Forecasts, UK; Prospects for Improved Forecasts of Weather and Short-Term Climate Variability on Subseasonal (2-Week to 2-Month) Times Scales; November 2002; Volume 23, pp. 51-53; In English; Also announced as 20030017775; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

Medium-range weather forecasting and seasonal forecasting are currently operational at ECMWF. These two systems have different physical bases. Medium-range forecasting targets the period from day 4 to day 10, and is usually considered as an atmospheric initial condition problem. It is generally believed that the time range is too small for the oceanic variability to play a significant role. Therefore, the medium-range forecasting systems at ECMWF are based on atmosphere-only integrations forced by initially observed SSTs. Deterministic medium-range weather forecasts are issued using a single integration of T511 with 60 vertical levels. Probabilistic forecasts called EPS are issued using a 51-member ensemble of T255L40 integrations twice a day. Seasonal forecasting at ECMWF focuses on the period between 1 and 6 months. It is considered as a boundary condition problem, since most of the predictability at the time scale is justified by the long predictability of the oceanic circulation and its impact on the atmospheric circulation. Because of the strong role of the oceanic variability at such long time-scales, seasonal forecasts at ECMWF are based on coupled ocean-atmosphere integrations. They are probabilistic based on a 40-member ensemble of coupled T95L40 integrations each month. In order to fill the gap between medium-range weather forecasting and seasonal forecasting, a new project is being developed at ECMWF called monthly forecasting. Its aim is to evaluate the predictability between day 10 and day 30. It is likely to be both an initial condition problem like seasonal forecasting. Therefore, the monthly forecasting system at ECMWF has been designed as a combination of EPS and seasonal forecasting.

Derived from text

*Atmospheric Circulation; Weather Forecasting; Air Water Interactions*

**20030017779** National Centers for Environmental Prediction, Environmental Modeling Center, USA

**The NCEP Global Ensemble: How to Go Beyond 16 Days?**

Toth, Z., National Centers for Environmental Prediction, USA; Zhu, Y., National Centers for Environmental Prediction, USA; Wobus, R., National Centers for Environmental Prediction, USA; Marchok, T., National Centers for Environmental Prediction, USA; Prospects for Improved Forecasts of Weather and Short-Term Climate Variability on Subseasonal (2-Week to 2-Month) Times Scales; November 2002; Volume 23, pp. 54; In English; Also announced as 20030017775; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The NCEP global ensemble system currently generates operational forecasts out to 16 days. In this talk different verification statistics will be presented to explore the skill of these forecasts in predicting daily weather events out to 16 days. Through case studies the possible impact of regime transitions on forecast skill will also be addressed. Additionally, experimental ensemble forecasts run out to 35 days lead time will be evaluated in terms of their skill. Possible future ensemble configurations that could contribute to a seamless suite of forecasts from day 1 to the climate time scales will also be discussed.

Author

*Predictions; Forecasting*

**20030017780** Cornell Univ., Dept. of Earth and Atmospheric Sciences, Ithaca, NY USA

**Ensemble Prediction of Blocking**

Colucci, Stephen J., Cornell Univ., USA; Prospects for Improved Forecasts of Weather and Short-Term Climate Variability on Subseasonal (2-Week to 2-Month) Times Scales; November 2002; Volume 23, pp. 55-58; In English; Also announced as 20030017775; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

Recent unpublished work reveals that ensemble prediction systems (EPSs) from the European Center for Medium-range Weather Forecasts (ECMWF) and the National Centers for Environmental Prediction (NCEP) can skillfully predict the occurrence of blocking over the Northern Hemisphere at extended ranges (ten days in advance and beyond). In the Pelly and Hoskins study, blocking is defined by a persistent, longitudinally coherent reversal of the normal meridional potential temperature gradient on the 2- PVU surface. With this definition, a blocking climatology was constructed from five years of ECMWF data and EPS forecasts were evaluated over one year. In the Watson and Colucci study, blocking is defined by a persistent, longitudinally coherent reversal of the normal meridional 500- mb height gradient over middle latitudes, following Tibaldi et al. (1994). With this definition, a blocking climatology was constructed from 40 years of NCEP data; EPS forecasts were evaluated over three winters. In both climatologies, maximum blocking frequency was found over the Atlantic and Pacific Oceans, allowing a separation of the data into Atlantic and Pacific sectors. Blocking frequency is underpredicted by both the ECMWF and NCEP EPSs. Results are shown for the NCEP forecasts in Figures (1-3). The underprediction bias can be corrected to produce calibrated probabilistic forecasts that extend the range of skillful blocking forecasts in the NCEP EPS, especially over the Atlantic (Figure

4). Block onset is found to be more difficult to forecast than block decay in the ECMWF EPS (not shown). These results are preliminary, since they are based upon a limited sample (three years of NCEP forecasts, one year of ECMWF forecasts), and therefore need to be checked for authenticity in a larger sample of forecasts.

Author

*Weather Forecasting; Temperature Gradients; Prediction Analysis Techniques*

**20030017781** National Centers for Environmental Prediction, USA

**[The Impact of Atmospheric Initial Conditions on Monthly Mean Hindcasts]**

Kumar, Arun, National Centers for Environmental Prediction, USA; Phelps, Michael W., Florida State Univ., USA; Prospects for Improved Forecasts of Weather and Short-Term Climate Variability on Subseasonal (2-Week to 2-Month) Times Scales; November 2002; Volume 23, pp. 59; In English; Also announced as 20030017775; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

In this analysis AGCM simulations for the monthly mean hindcasts with different lead times are analyzed. For example, for the 1979-99 period, AGCM simulations starting from the atmospheric initial conditions in September, October, November, and December are analyzed for the hindcasts for the month of January. The purpose of this analysis is to evaluate the impact of atmospheric initial conditions on the hindcasts, for it is expected that hindcasts with the shortest lead (for example, the hindcasts from December for the target month of January compared to the hindcasts from September for the month of January) will have a higher level of simulation skill. Different measures to assess the role of initial conditions on the monthly mean variability are used. These include the analysis of internal and external variances with different lead times, the analysis of simulation skill with different lead times, and the analysis of low-frequency modes of the atmospheric variability with different lead times.

Author

*Hindcasting; Variability; Meteorology*

**20030017782** Scripps Institution of Oceanography, La Jolla, CA USA

**The Role of Atmospheric Initial Conditions for Long-Range Predictability**

Reichler, T. J., Scripps Institution of Oceanography, USA; Roads, J. O., Scripps Institution of Oceanography, USA; Prospects for Improved Forecasts of Weather and Short-Term Climate Variability on Subseasonal (2-Week to 2-Month) Times Scales; November 2002; Volume 23, pp. 60; In English; Also announced as 20030017775; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

We examine the relative importance of the atmospheric initial state and boundary forcing for long-range atmospheric predictability using the seasonal forecasting model from the National Centers for Environmental Prediction. A series of ensemble predictability experiments are conducted, using different combinations of initial and boundary conditions. The experiments are verified globally against a reference run with the same model as well as against reanalysis. We analyze the unaveraged forecast skill from day one out to a season and compare it with seasonally averaged data. We find that from initial conditions alone, there is significant instantaneous forecast skill out to 2 months. Different initial conditions show different predictability using the same kind of boundary forcing. Boundary forcing leads to measurable instantaneous forecast skill at any lead time: It starts to impact predictability after 10 days, it is equally important as initial conditions after 4 weeks, and it completely determines the forecast after 6 weeks. During events with strong tropical forcing, these time scales are somewhat shorter. For seasonally averaged skill, using observed atmospheric initial conditions can lead to a significant increase in overall skill, especially during periods with weak tropical forcing. We conclude that the long-term memory of the initial conditions is important for seasonal forecasting, and that good atmospheric initial conditions should be included in current seasonal forecasts.

Author

*Boundary Conditions; Forecasting; Predictions; Meteorology*

**20030017783** Joint Inst. for the Study of the Atmosphere and Ocean, Seattle, WA USA

**Impacts of the Arctic Oscillation and the PNA Pattern on Weather**

Quadrelli, Roberta, Joint Inst. for the Study of the Atmosphere and Ocean, USA; Wallace, John M., Joint Inst. for the Study of the Atmosphere and Ocean, USA; Prospects for Improved Forecasts of Weather and Short-Term Climate Variability on Subseasonal (2-Week to 2-Month) Times Scales; November 2002; Volume 23, pp. 63-66; In English; Also announced as 20030017775; Original contains color illustrations; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

Over large areas of the Northern Hemisphere, the influence of the AO upon the frequency of occurrence of extreme cold is stronger than one would expect, based on its effect on mean temperature alone. Apparently, the temperature field in these regions exhibits stronger temporal variability when the AO is in its low index polarity, with relatively weak subpolar westerlies, than when it is in its high index polarity. In order to elucidate this behavior, we examine the circulation regimes observed during contrasting

polarities of the AO (and the PNA pattern as well). After presenting the phase space defined by the two modes together and its impact on the large scale temperature variability we show a series of "spaghetti diagrams"- selected contours extracted from the 10-day mean maps of the 500-mb height, sea-level pressure, and 1000-500-mb thickness fields for the 30 highest and lowest mean values of each of the indices. The plots reveal that the AO and the PNA pattern do, indeed, exert a strong influence on the frequency of occurrence of the distinctive flow regimes that are often associated with cold air outbreaks in midlatitudes.

Author

*Arctic Regions; Atmospheric Circulation; Oscillations; Temperate Regions; Weather*

**20030017784** NorthWest Research Associates, Inc., Bellevue, WA USA

**Statistical Prediction of the Arctic Oscillation**

Baldwin, Mark P., NorthWest Research Associates, Inc., USA; Dunkerton, Timothy J., NorthWest Research Associates, Inc., USA; Prospects for Improved Forecasts of Weather and Short-Term Climate Variability on Subseasonal (2-Week to 2-Month) Times Scales; November 2002; Volume 23, pp. 67; In English; Also announced as 20030017775; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

The Arctic Oscillation (AO) is the surface expression of the Northern Annular Mode (NAM), which can be defined at any pressure level from 1000 hPa to the mesosphere. Here we explore the possibility of predicting the average value of the AO 10-40 days in the future, based on today's value of the AO and values of the NAM at stratospheric levels. We first note that there is a strong seasonality in the autocorrelation of the AO; it is substantially more persistent during the winter season (the season when planetary wave coupling to the stratosphere is strongest). Outside the winter season, the e-folding time scale of the AO is approx. 15-20 days during DJF, and approx. 5-6 days from April-October. The NAM is more persistent at stratospheric levels, peaking at 150 hPa in the lowermost stratosphere, where the DJF e-folding time scale exceeds 30 days.

Derived from text

*Statistical Analysis; Arctic Regions; Oscillations; Prediction Analysis Techniques*

**20030017785** Pennsylvania State Univ., EMS Environment Inst., University Park, PA USA

**Dynamical Mechanisms Associated With the Growth and Decay of the North Atlantic Oscillation (NAO) Teleconnection Pattern**

Feldstein, Steven, Pennsylvania State Univ., USA; Prospects for Improved Forecasts of Weather and Short-Term Climate Variability on Subseasonal (2-Week to 2-Month) Times Scales; November 2002; Volume 23, pp. 68; In English; Also announced as 20030017775; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

This investigation performs both diagnostic analyses with NCEP/NCAR Reanalysis data and forced, barotropic model calculations to examine the dynamical mechanisms associated with the growth and decay of the North Atlantic Oscillation (NAO) teleconnection pattern. The diagnostic calculations include projection and composite analyses of each term in the streamfunction tendency equation. The results of the analyses reveal a complete lifecycle of growth and decay within approximately two weeks. The positive NAO phase is found to develop after anomalous wave-train propagation across the North Pacific to the east coast of North America. This contrasts with the negative NAO phase which appears to develop in-situ. Both high-frequency (period 10 days) and low-frequency (period 10 days) transient eddy fluxes drive the NAO growth. After the NAO anomaly attains its maximum amplitude, the high-frequency transient eddy fluxes continue to drive the NAO anomaly in a manner that is consistent with a positive feedback process. The decay of the NAO occurs through both the divergence term and the low-frequency transient eddy fluxes. The temporal and spatial properties of the divergence term are found to be consistent with Ekman pumping. These results illustrate many important differences between the NAO and Pacific/North American (PNA) teleconnection patterns, perhaps most striking being that the NAO lifecycle is dominated by nonlinear processes, whereas the PNA evolution is primarily linear. In addition, the relation between the NAO and the zonal index is discussed.

Author

*Anomalies; Atlantic Ocean; Divergence; Oscillations; Teleconnections (Meteorology); Wave Propagation*

**20030017786** National Oceanic and Atmospheric Administration, Boulder, CO USA

**Distant Teleconnections via the Tropospheric Jetstream Waveguide**

Branstator, Grant, National Oceanic and Atmospheric Administration, USA; Prospects for Improved Forecasts of Weather and Short-Term Climate Variability on Subseasonal (2-Week to 2-Month) Times Scales; November 2002; Volume 23, pp. 69-70; In English; Also announced as 20030017775; Original contains color illustrations; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

Planetary wave theory suggests that low-frequency covariability between widely spaced points on the globe can be achieved without resorting to annular disturbances. This is able to happen because the time averaged tropospheric jets can act as waveguides

which meridionally trap and zonally elongate wave-trains in their vicinity, as seen in solutions of the barotropic vorticity equation linearized about boreal winter upper tropospheric conditions. We examine the behavior of seasonal and sub-seasonal mean circulation anomalies in nature and in NSIPP and NCAR general circulation models to determine whether this behavior is observed.

Derived from text

*Waveguides; Vorticity Equations; Tropospheric Waves; Teleconnections (Meteorology); Atmospheric General Circulation Models*

**20030017787** Maryland Univ., USA

**On the Origin and Mature-Phase Dynamics of PNA Variability**

Nigam, Sumant, Maryland Univ., USA; Prospects for Improved Forecasts of Weather and Short-Term Climate Variability on Subseasonal (2-Week to 2-Month) Times Scales; November 2002; Volume 23, pp. 71; In English; Also announced as 20030017775; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

A prominent mode of winter climate variability is the geographically well-defined Pacific North American (PNA) pattern, which represents circulation and precipitation variability on both intraseasonal and seasonal time-scales. The mode is linked with midlatitude Pacific SST variability, but has sometimes been erroneously associated with ENSO variability as it can be excited during ENSO winters as well. The talk will focus on the extraction of PNA structure (rotational and divergent circulations) and forcing (diabatic heating, vorticity and thermal transients) from reanalysis data sets. The pattern is then simulated from the diagnosed forcing using a steady linear primitive equation model. A good simulation allowed pursuit of the dynamical diagnosis strategy, the objective of which is to reveal the mature-phase maintenance mechanisms. Modeling analysis indicates the considerable role of zonal/eddy coupling and sub-monthly vorticity transients in the pattern's generation. Ongoing analysis of PNA evolution at weekly resolution indicates that a typical 2-week long episode begins with an eastward extension of the east Asian jet, with zonal wind anomalies at 200mb extending 20-30 beyond the dateline. From this point onwards, a sequence of events, including displacement of Pacific storm tracks, occur, spurred, in part, by the balance-restoring secondary circulations. The origin of the precursor phase jet extensions is unclear at present, although linkage with Kuroshio variability is being investigated. A better understanding of PNA excitation and dynamics can clearly influence predictions of short-term climate variability.

Author

*Pacific Ocean; North America; Climate; Heat Transfer; Mathematical Models; Vortices*

**20030017790** National Centers for Environmental Prediction, Climate Prediction Center, USA

**Monitoring the AO/PNA Indices Using NCEP/NCAR CDAS/Reanalysis**

Kim, Hyun-jyung, National Centers for Environmental Prediction, USA; Higgins, Wayne, National Centers for Environmental Prediction, USA; Prospects for Improved Forecasts of Weather and Short-Term Climate Variability on Subseasonal (2-Week to 2-Month) Times Scales; November 2002; Volume 23, pp. 77; In English; Also announced as 20030017775; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The Arctic Oscillation (AO) and the Pacific / North American pattern (PNA) are two of the dominant modes of atmospheric variability in the Northern Hemisphere (NH), in particular during cold season. These indices are strongly associated with weather and climate variability over a large portion of the NH. For the purpose of improving weather and climate prediction at NCEP, these indices were developed for the period from January 1950 to the present using the NCEP/NCAR CDAS/Reanalysis. Since there is no explicit way to predict these indices yet, the "predicted" indices are generated by projecting the loading pattern of each mode onto the MRF and Ensemble forecast data in order to help the weather and climate prediction. The indices and forecasts for the most recent 120 days are posted on the monitoring weather and climate web site of NCEP/CPC and updated daily. (<http://www.cpc.ncep.noaa.gov/products/precip/CWlink> ) For the comparison with AO, the North Atlantic Oscillation (NAO) has also been monitored. The Antarctic Oscillation (AAO) has also been monitored as the counterpart of the AO in the Southern Hemisphere. All monitoring products are updated on a daily basis. Several of these will be demonstrated in our talk.

Author

*Antarctic Regions; Arctic Regions; Atlantic Ocean; Climate; Forecasting; Weather Forecasting*

**20030017791** State Univ. of New York, Inst. for Terrestrial and Planetary Atmospheres, Stony Brook, NY USA

**Predictability and Forecast Issues Associated with the MJO/ISO**

Waliser, Duane E., State Univ. of New York, USA; Prospects for Improved Forecasts of Weather and Short-Term Climate Variability on Subseasonal (2-Week to 2-Month) Times Scales; November 2002; Volume 23, pp. 81-87; In English; Also announced as 20030017775; Original contains color illustrations; No Copyright; Avail: CASI; A02, Hardcopy; A02, Microfiche

Since its discovery by Madden and Julian (1971) over two decades ago, the Madden and Julian Oscillation [MJO/ISO; a.k.a. Intraseasonal Oscillation (ISO)] has continued to be a topic of significant interest due to its complex nature (Madden and Julian, 1994) and the wide range of phenomena it interacts with. The onset and break activity of the Asian-Australian monsoon system are strongly influenced by the propagation and evolution of MJO/ISO events. Apart from this significant local influence, there are also important downstream influences that arise from the MJO/ISO. For example, the development of persistent North Pacific (PNP) circulation anomalies during Northern Hemisphere winter has been linked to the evolution and eastward progression of convective anomalies associated with MJO/ISO events. In fact, a strong link has been shown to exist between rainfall variability along the western USA, including extreme events, and the longitudinal position of MJO/ISO convective anomalies. In addition, MJO/ISO convective activity has been linked to Northern Hemisphere summer time precipitation variability over Mexico and South America as well as to wintertime circulation anomalies over the Pacific - South American Sector. Recently, studies have also shown that particular phases of the MJO/ISO are more favorable than others in regards to the development of tropical storms/hurricanes in both the Atlantic and Pacific sectors. Finally, the passage of MJO/ISO events over the western Pacific Ocean has been found to significantly modify the thermocline structure in the equatorial eastern Pacific Ocean via their connection to westerly wind bursts. This latter interaction has even been suggested to play an important role in triggering variations in El Nino - Southern Oscillation (ENSO).

Derived from text

*Predictions; Forecasting; Mathematical Models; Pacific Ocean*

**20030017792** NASA Goddard Space Flight Center, Greenbelt, MD USA

**The MJO-ENSO Relationship: A Re-assessment**

Lau, William K. M., NASA Goddard Space Flight Center, USA; Kim, K. M., NASA Goddard Space Flight Center, USA; Prospects for Improved Forecasts of Weather and Short-Term Climate Variability on Subseasonal (2-Week to 2-Month) Times Scales; November 2002; Volume 23, pp. 88-91; In English; Also announced as 20030017775; Original contains color illustrations; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

Noting the similarities among the spatial patterns of outgoing longwave radiation among MJO and ENSO, Lau and Chan speculated a possible relationship between the two phenomena. This speculation received a substantial boost in credibility after the 1997-98 El Nino, when MJO activities were found to be substantially enhanced prior to the onset of the warm phase, and clear signals of oceanic Kelvin waves forced by MJO induced anomalous surface wind were detected as possible triggers of ENSO. Yet statistical and modeling studies have so far yielded either nil or at best, very weak relationship between MJO activities and SST. Recently Kessler suggested using an MJO index which includes convective variability in the equatorial central Pacific lead to a more robust MJO-ENSO relationship. Clearly, while MJO might have been instrumental in triggering some El Nino, there are other events that can occur without any MJO trigger.

Derived from text

*Climate Models; Tropical Regions; Temperate Regions; Statistical Analysis; Convection; Radiation*

**20030017793** Florida State Univ., Dept. of Meteorology, Tallahassee, FL USA

**Recent Failures of Monsoon-ENSO Relationships Viewed From Coupled Model Results**

Chakraborty, Arun, Florida State Univ., USA; Krishnamurti, T. N., Florida State Univ., USA; Prospects for Improved Forecasts of Weather and Short-Term Climate Variability on Subseasonal (2-Week to 2-Month) Times Scales; November 2002; Volume 23, pp. 92; In English; Also announced as 20030017775; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

We are in the course of preparing data sets for a multimodel ensemble of seasonal forecasts. These are based on eight versions of the FSU global coupled model following LaRow and Krishnamurti. In addition to those we have prepared parallel data sets for as many as four external non-FSU global coupled model runs. Although the entire array covering several decades of seasonal forecasts experiments are not yet completed, some preliminary results from several single model runs were possible at this stage. One of the questions we address here is on the recently reported failures of the ENSO - Monsoon relationship. Prior to 1995 there was the general feeling that El-Nino years were to be treated as deficient in Indian monsoon rainfall with the converse being the case for the La-Nina years. Recent papers by several authors observed the failure of this relationship since roughly 1995. Our study examines the coupled model results on the relationship of ENSO index and the all India summer monsoon rainfall (AISMR). We find that the model output does confirm a breakdown of this relationship. In the course of further diagnosis of this relationship, we noted a prominent feature that prevailed prior to 1995 that was absent in the subsequent years. The model output showed that the amplification of the MJO signals in the zonal winds at 850hPa levels and of the ENSO signals were both large during years of above normal AISMR. During years of deficient AISMR the MJO signal amplitudes were small. The differences in the amplitudes of ENSO and MJO signals were inversely related to the AISMR. Even that relationship broke down after 1995. Since

the complete global coupled model output is available at intervals of every week we feel that this data sets provides an opportunity for the examination of other non-conventional parameters that might provide a clue to the behavior of the breakdown of these relationships and to search for other possible candidates. These results will be presented at the workshop on subseasonal climate prediction.

Author

*Monsoons; Sensory Feedback; Predictions; Forecasting; Failure; Climate*

**20030017794** California Univ., Inst. for Computational Earth Systems Science (ICESS), Santa Barbara, CA USA

**Variability of Tropical Intraseasonal Convective Anomalies and Their Statistical Forecast Skill**

Jones, Charles, California Univ., USA; Carvalho, Leila M. V., California Univ., USA; Higgins, Wayne, California Univ., USA; Waliser, Duane, California Univ., USA; Schemm, Jae-K. E., California Univ., USA; Prospects for Improved Forecasts of Weather and Short-Term Climate Variability on Subseasonal (2-Week to 2-Month) Times Scales; November 2002; Volume 23, pp. 93; In English; Also announced as 20030017775; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The tropical atmosphere exhibits significant amounts of variance on time scales of 20-90 days. In particular, the Madden-Julian Oscillation (MJO) is the main mode of tropical intraseasonal variation with significant influences on the Asian-Australian Monsoons, Indo-Pacific thermocline variability and mid-latitude teleconnections. Previous works have shown that tropical intraseasonal convective anomalies (TICA) display different modes of eastward propagation, seasonal and interannual occurrences. This study examines the characteristics of eastward propagating TICA events. An objective-tracking algorithm is applied to 22 years of Outgoing Longwave Radiation (OLR) data to characterize their propagation, life cycle, zonal displacement and structural properties (minimum OLR anomaly, variance of OLR anomaly, area, number of cold clusters, rate of growth and decay). The zonal wind (U) components at 850 hPa and 200 hPa from 22 years of NCEP/NCAR reanalysis are used to describe the large-scale circulation associated with TICA events. Four main TICA types are recognized depending on their eastward propagation and region of most significant influence (Indian Ocean, India/China Sea, SPCZ and Pacific Ocean). A statistical analysis is carried out to determine if differences in structural properties of convective anomalies are also associated with different TICA types. Probability curves are then constructed to determine the likelihood of TICA occurrences according to their zonal displacement and frequency per season. In the last part of this work, a combined (CEOF) analysis of OLR, U850, and U200 is performed to build a statistical forecast model based on multiple linear regressions using the first two leading EOF modes. The statistical forecast skills of different TICA types are analyzed and their implications for midlatitude teleconnections are discussed.

Author

*Variability; Tropical Regions; Convection; Anomalies; Statistical Analysis; Teleconnections (Meteorology)*

**20030017795** Bureau of Meteorology, Climate Forecasting Group, Melbourne, Australia

**An All-Season Real-Time Multivariate MJO Index: Development of the Index for Monitoring and Prediction in Australia**

Wheeler, Matthew C., Bureau of Meteorology, Australia; Hendon, Harry H., Bureau of Meteorology, Australia; Prospects for Improved Forecasts of Weather and Short-Term Climate Variability on Subseasonal (2-Week to 2-Month) Times Scales; November 2002; Volume 23, pp. 94-97; In English; Also announced as 20030017775; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

As part of an ongoing research project at the Australian Bureau of Meteorology on the use of the Madden-Julian Oscillation (MJO) for forecasting on the intraseasonal time scale, we have developed an index for the MJO based on the first two Empirical Orthogonal Functions (EOFs) of the combined fields of near-equatorial 850 hPa zonal wind, 200 hPa zonal wind, and satellite-observed outgoing longwave radiation (OLR). Projection of the daily observed data onto such multivariate EOFs, with the annual cycle and El Nino variability removed, yields principal component (PC) time series that vary mostly on the intraseasonal time scale of the MJO only. That is, the projection of daily data onto the two EOFs is a very effective filter for the MJO, without the need for time filtering, and thus an effective index for real-time use. In this way, it is thought to be an improvement over the method that is currently performed daily at the Bureau, of Wheeler and Weickmann (2001). This paper explores the properties of the index along with its relationship to other important weather and climate parameters. Prediction of the index will follow in later work and publications.

Author

*Real Time Operation; Wind (Meteorology); Weather; Multivariate Statistical Analysis; Forecasting; Climate*

**20030017796** NASA Goddard Space Flight Center, Greenbelt, MD USA

**Evidence of an Intrinsic Intraseasonal Oscillation over Tropical South America During Austral Summer**

Zhou, Jiayu, NASA Goddard Space Flight Center, USA; Lau, William K.-M., NASA Goddard Space Flight Center, USA; Prospects for Improved Forecasts of Weather and Short-Term Climate Variability on Subseasonal (2-Week to 2-Month) Times Scales; November 2002; Volume 23, pp. 98-102; In English; Also announced as 20030017775; Original contains color illustrations; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

The intraseasonal variation (ISV) in the 30-60 day band, also known as Madden-Julian oscillation (MJO), has been studied for decades. Madden and Julian showed that the oscillation originated from the western Indian Ocean, propagated eastward, got enhanced over the maritime continent and weakened after passing over the dateline. Composite studies showed evidences of a signal in upper and lower level zonal wind propagating around the globe during an oscillation. Theoretical studies pointed out that the interaction with the warm ocean surface and the coupling with the convective and radiative processes in the atmosphere could manifest the oscillation, which propagates eastward via mutual feedbacks between the wave motions and the cumulus heating. Over tropical South America, no independent 30-60 day oscillation has been reported so far, despite that Amazon is the most distinct tropical convection center over the western hemisphere and the fluxes from its surface of tropical rainforests are close to that from the warm tropical ocean. Liebmann et al. showed a distinct spectral peak of 40-50 day oscillation in outgoing longwave radiation (OLR) over tropical South America and considered that was manifested by the MJO propagation. Nogues-Paegle et al. (2000) focused on a dipole pattern of the OLR anomaly with centers of action over the South Atlantic Convergence Zone (SACZ) and the subtropical plain. They used the regional 10-90 day filtered data and demonstrated this pattern could be represented by the fifth mode of the rotated empirical orthogonal function. Its principal component was further analyzed using the singular spectrum analysis. Their result showed two oscillatory modes with periods of 36-40 days and 22-28 days, of which the former was related to the MJO influence and the latter linked to the remote forcing over southwest of Australia, which produced a wave train propagating southeastward, rounding the southern tip of South America and returning back toward the northeast. The 22-28 day mode has distinct impact on SACZ, responsible for the regional seesaw pattern of alternating dry and wet conditions. In this study we will focus on the 30-60-day spectral band and investigate whether the independent oscillation source over tropical South America is existed. First, we will show the seasonal dependence of the tropical South American ISV in Section 3. Then, the leading principal modes of 30-60 day bandpass filtered 850-hPa velocity potential (VP850) will be computed to distinguish the stationary ISV over tropical South America (SISA) from the propagating MJO in the austral summertime in Section 4. The importance of SISA in representing the regional ISV over South America will be discussed. In Section 5, we will demonstrate the mass oscillation regime of SISA, which is well separated from that of MJO by the Andes, and the convective coupling with rainfall. The dynamical response of SISA and the impact on the South American summer monsoon (SASM) will be presented. Finally, we will give the concluding remarks.

Author

*Anomalies; Convection; Dynamic Response; Long Wave Radiation; Madden-Julian Oscillation; Ocean Surface; Tropical Regions; Wind (Meteorology)*

**20030017797** Bureau of Meteorology, Australia

**Dynamical Seasonal Predictability of the Asian Summer Monsoon**

Sperber, K. R., Bureau of Meteorology, Australia; Brankovic, C., Bureau of Meteorology, Australia; Deque, M., Bureau of Meteorology, Australia; Frederiksen, C. S., Bureau of Meteorology, Australia; Graham, R., Bureau of Meteorology, Australia; Kitoh, A., Bureau of Meteorology, Australia; Kobayashi, C., Bureau of Meteorology, Australia; Palmer, T., Bureau of Meteorology, Australia; Puri, K., Bureau of Meteorology, Australia; Tennant, W., Bureau of Meteorology, Australia; Volodin, E., Bureau of Meteorology, Australia; Prospects for Improved Forecasts of Weather and Short-Term Climate Variability on Subseasonal (2-Week to 2-Month) Times Scales; November 2002; Volume 23, pp. 103; In English; Also announced as 20030017775; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Ensembles of hind-casts from seven modes are analyzed to evaluate dynamical seasonal predictability of 850hPa wind and rainfall for the Asian summer monsoon (ASM) during 1987, 1988, and 1993. These integrations were performed using observed sea surface temperatures and from observed initial conditions. The experiments were designed by the CLIVAR Working Group on Seasonal to Interannual Prediction as part of the Seasonal prediction Model Intercomparison Project (SMIP). Integrations from the European Union PROVOST (Prediction of climate Variations on Seasonal to interannual Timescales) experiment are also evaluated. The National Centers for Environmental Prediction/National Center for Atmospheric Research and European Centre for Medium-Range Weather Forecasts reanalyses and observed pentad rainfall form the baseline against which the hindcasts are judged. Pattern correlations and root-mean-square differences indicate errors in the simulation of the time-mean low-level flow and the rainfall exceed observational uncertainty. Most models simulate the sub-seasonal EOFs that are associated with the dominant variations of the 850hPa flow during the ASM, but not with the fidelity exhibited by the reanalyses as determined using

pattern correlations. Pattern correlations indicate that the first EOF, associated with the tropical convergence zone being located over the continental landmass, is best simulated. The higher order EOFs are less well simulated, and errors in the magnitude and location of their associated precipitation anomalies compromise dynamical seasonal predictability, and are related to errors of the mean state. In most instances the models fail to properly project the sub-seasonal EOFs/PCs onto the interannual variability with result that hindcasts of the 850hPa flow and rainfall are poor. In cases where the observed EOFs are known to be related to the boundary forcing, the failure of the models to properly project the EOFs onto the interannual variability indicates that the models are not setting up observed teleconnection patterns.

Author

*Monsoons; Mathematical Models; Climate; Correlation; Teleconnections (Meteorology)*

**20030017798** NASA Goddard Space Flight Center, Greenbelt, MD USA

**Experiments with a Data Assimilation System to Diagnose AGCM Hindcasts of the MJO**

Wu, Man Li C., NASA Goddard Space Flight Center, USA; Schubert, Siegfried D., NASA Goddard Space Flight Center, USA; VanPelt, Derek, NASA Goddard Space Flight Center, USA; Waliser, Duane, State Univ. of New York, USA; Prospects for Improved Forecasts of Weather and Short-Term Climate Variability on Subseasonal (2-Week to 2-Month) Times Scales; November 2002; Volume 23, pp. 104-107; In English; Also announced as 20030017775; Original contains color illustrations; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

The objectives of this study are to (1) develop a better understanding of how observations constrain/impact the MJO in a data assimilation system with the aim of improving the representation of the MJO, and (2) to carry out AGCM predictability/forecast experiments under various observational constraints to assess model errors and sensitivity to initial conditions. Our current focus is on the second objective.

Derived from text

*Experimentation; Data Systems; Hindcasting; Moisture; Parameterization; Assimilation*

**20030017799** National Oceanic and Atmospheric Administration, Climate Diagnostics Center, Boulder, CO USA

**Tropical Influences on Subseasonal Extratropical Variability and Predictability**

Sardeshmukh, Prashant D., National Oceanic and Atmospheric Administration, USA; Prospects for Improved Forecasts of Weather and Short-Term Climate Variability on Subseasonal (2-Week to 2-Month) Times Scales; November 2002; Volume 23, pp. 111-114; In English; Also announced as 20030017775; Original contains color illustrations; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

This talk emphasized three points: 1) A large fraction of the total power of extratropical tropospheric height variability resides in the intraseasonal band; 2) much of the predictability on this time scale can be captured by simple multilinear Markov models; and 3) tropical forcing is a major (though not the only) source of this predictability. In support of point 1, it was shown that to a first approximation the average wintertime power spectrum of 500 mb heights for northern hemispheric grid-points poleward of 20 N is well approximated by that of red noise with a 3-day correlation scale. The hemispherically averaged variances of daily, weekly, monthly and seasonal-average anomalies are also consistent with that of 3day red noise. It was further emphasized that about 88% of the total power of a red noise time series lies between periods of 0.1 and 10 times the characteristic period, which for 3-day red noise is  $271 \times 3 - 18$  days. Thus a large part of the total power lies in the intraseasonal band. Shorter-scale synoptic variability modifies this picture somewhat in the western ocean basins, but longer term interannual and interdecadal variability remains modest in comparison, even in the eastern ocean basins. Also consistent with this picture, one-point teleconnection maps of daily, weekly, monthly, and seasonal average anomalies for base points in the north Pacific and Atlantic have a remarkably similar spatial structure across these time scales.

Derived from text

*Tropical Regions; Variability; Predictions; Teleconnections (Meteorology)*

**20030017800** National Oceanic and Atmospheric Administration, Climate Diagnostics Center, Boulder, CO USA

**Mid-latitude Mountains and the MJO: A Prototype for Tropical-Extratropical Interaction?**

Weickmann, Klaus M., National Oceanic and Atmospheric Administration, USA; Prospects for Improved Forecasts of Weather and Short-Term Climate Variability on Subseasonal (2-Week to 2-Month) Times Scales; November 2002; Volume 23, pp. 115; In English; Also announced as 20030017775; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The Madden-Julian oscillation produces a robust, repeatable signal in global and zonal atmospheric angular momentum (AAM). During northern winter, the MJO zonal wind anomalies appear first on the equator in the western hemisphere and then shift to the eastern hemisphere, stretching from the north Indian Ocean to the central Pacific Ocean. Global AAM anomalies

increase and reach a maximum during this evolution. Studies of the torques that produce the AAM variations show Asian and North American mountains contribute to the mountain torque anomalies when analyzing 30-70 day filtered data but not when analyzing data based on a MJO index. The Andes and African Highlands make a larger contribution during an MJO. Subsequent observational studies of the mountain and frictional torque reveal an independent coherent evolution of the mid-latitude circulation that involves the adjustment by the atmosphere to stochastically-varying flow over the mid-latitude mountains. In this case, the frictional torque responds to strong or persistent mountain torque events in a matter of days and the response includes the PNA teleconnection pattern. The intraseasonal AAM variations thus involve the interaction of mostly independent processes in the tropics and mid-latitudes. Some recent cases are presented.

Author

*Wind (Meteorology); Tropical Regions; Teleconnections (Meteorology); Mountains; Intraseasonal Variations; Atmospheric Circulation*

**20030017801** National Oceanic and Atmospheric Administration, Climate Diagnostics Center, Boulder, CO USA

**Influences of the Madden Julian Oscillations on Temperature and Precipitation in North America during ENSO-Neutral and Weak ENSO Winters**

Xue, Yan, National Oceanic and Atmospheric Administration, USA; Higgins, Wayne, National Oceanic and Atmospheric Administration, USA; Kousky, Vernon, National Oceanic and Atmospheric Administration, USA; Prospects for Improved Forecasts of Weather and Short-Term Climate Variability on Subseasonal (2-Week to 2-Month) Times Scales; November 2002; Volume 23, pp. 116-119; In English; Also announced as 20030017775; Original contains color illustrations; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

A number of studies have shown that the Madden-Julian Oscillation (MJO) have a strong influence on the atmospheric circulation and precipitation patterns in the tropical and extratropics. Recent studies also suggest that the MJO-related tropical forcing is linked to precipitation events along the west coast of the United State during the winter season. Dynamical models generally simulate the MJO quite poorly, partly because of inherent difficulties in parameterizing tropical convection. Statistical prediction models have shown a modest skill relating sub-seasonal variations in tropical convection to week-2 prediction of wintertime rainfall in western North America. Operational week two ensemble predictions show levels of skill that are comparable to the statistical forecasts. However, neither statistical or dynamical prediction models have demonstrated useful levels of skill in forecasting MJO-related impacts beyond week 2. We believe that improved monitoring and assessment of the MJO and its impacts on the atmospheric circulation and precipitation patterns will lead to better prediction. In this work we focus on ENSO-neutral and weak ENSO winters since the MJO is known to be quite active during those times. Velocity potential at 200-hPa has been used to construct a composite index for life cycles of the MJO. A similar approach is taken here. An extended Empirical Orthogonal Function (EEOF) analysis is applied to the bandpass filtered (25-87 days) pentad velocity potential at 200-hPa for ENSO-neutral and weak ENSO winters (November-April) during 1979-2000. The first EEOF is composed of ten time-lagged patterns. We construct ten the ten patterns of the first EEOF. Keyed on the ten MJO indices, ten composites for the major MJO events are derived for various fields, including surface air temperature and precipitation. Our composites are constructed with unfiltered pentad data in which the winter season mean is removed. Significant MJO-related influences on surface air temperature and precipitation in North America are found. The potential predictability for those fields derived from the tropical MJO-related forcing is discussed.

Author

*Precipitation (Meteorology); North America; Winter; Southern Oscillation; Prediction Analysis Techniques; Atmospheric Temperature*

**20030017802** California Univ., Inst. for Computational Earth Systems Science, Santa Barbara, CA USA

**The Role of MJO Activity Modulating the SACZ Persistence, Intensity and Form, and Regional Impacts on Extreme Precipitation Events**

Carvalho, Leila M. V., California Univ., USA; Jones, Charles, California Univ., USA; Liebmann, Brant, California Univ., USA; Prospects for Improved Forecasts of Weather and Short-Term Climate Variability on Subseasonal (2-Week to 2-Month) Times Scales; November 2002; Volume 23, pp. 120; In English; Also announced as 20030017775; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The tropical atmosphere exhibits significant amounts of variance on time scales of 20-90 days. In particular, the Madden-Julian Oscillation (MJO) is the main mode of tropical intraseasonal variation with large influences on the Asian-Australian Monsoons and mid-latitude teleconnections. Previous works have shown that intraseasonal variations play an important role on the variability of the South American Monsoon System (SAMS). The South Atlantic Convergence Zone is part of the SAMS and its variability affects large areas of tropical and subtropical South America. This study examines the influence

of the MJO on the intensity, persistence, and form of the SACZ and regional implications for the occurrence of extreme precipitation over Brazil. Daily Outgoing Longwave Radiation (OLR) is examined during 22 years to characterize convective activity in the SACZ. An objective algorithm is applied to identify OLR properties related to intensity and form of the SACZ such as area, minimum OLR, fraction with minimum OLR, eccentricity, and extent to the Atlantic Ocean and the Amazon. Factor analysis is then applied to time series of OLR properties to characterize the SACZ features. Two factors explain approx. 65% of the total variance of the convective activity patterns in the SACZ and characterize events according to the intensity (Factor-1) and extent of the OLR features to the Atlantic Ocean (Factor-2). Factor-1 is then used as an index to infer persistence of intense SACZ episodes. Factor-2 characterizes distinct situations when convection is displaced to the Atlantic Ocean or more continental. The MJO episodes are characterized independently using filtered OLR (10-90 days) data and principal components analysis. The propagation of midlatitudes wave train is also investigated using filtered OLR (10-90 days) data but with a distinct procedure. Precipitation over Brazil is examined with data from stations interpolated in a grid of 2 x 2 deg. of latitude and longitude. It is shown that MJO events modulate approximately 30% of the total SACZ episodes with persistence greater than 3 days. The midlatitude wave trains modulate the SACZ extent to the Atlantic Ocean. It is shown that there are significant regional impacts in the occurrence of extreme precipitation over Brazil related to MJO occurrences and to the midlatitude wave train. The relationships between the occurrence of MJO and the wave train are also investigated.

Author

*Madden-Julian Oscillation; Tropical Regions; Precipitation (Meteorology); Teleconnections (Meteorology); Intraseasonal Variations*

**20030017803** Iowa State Univ. of Hospitals and Clinics, USA

**Modulation of the North Pacific-Pacific Northwest Storm Activity by MJO**

Chen, T. C., Iowa State Univ. of Hospitals and Clinics, USA; Li, David, Iowa State Univ. of Hospitals and Clinics, USA; Hsieh, Peter, Iowa State Univ. of Hospitals and Clinics, USA; Alpert, Jordan, Iowa State Univ. of Hospitals and Clinics, USA; Prospects for Improved Forecasts of Weather and Short-Term Climate Variability on Subseasonal (2-Week to 2-Month) Times Scales; November 2002; Volume 23, pp. 121; In English; Also announced as 20030017775; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The x-t diagram of precipitation along 45 deg. N were constructed over the North Pacific-Pacific Northwest region for the last twenty years, with different data sources: precipitation generated by the GEOS-1 and NCEP/NCAR reanalysis, Goddard precipitation estimates, and OLR. A clear 30-60 day modulation of the eastward migration of storm tracks emerges from these x-t diagrams. Storm tracks migrates eastward when the MJO deepens the Aleutian low. It was shown by our previous study (Chen and Alpert 1990 MWR) that the descent forecast skill of the planetary-scale divergent circulation can reach five days by the NMC medium-range forecasts (MRF). Thus, an effort is undertaking to explore how many days the modulation of the North Pacific-Pacific Northwest storm track activity by the MJO can properly predicted by the NCEP MRF. Preliminary results show that the five-day forecast skill generally can be obtained. However, the forecast skill may exceed this limit when the MJO is strong and well-organized.

Author

*Pacific Ocean; Storms; Migration; Forecasting*

**20030017806** Institute of Global Environment and Society, Inc., Center for Ocean-Land-Atmosphere Studies, Calverton, MD USA

**The Impact of Sub-seasonal Sea Surface Temperature Variability on the Simulation of the Seasonal Mean Extra-tropical Circulation**

Kirtman, Ben, Institute of Global Environment and Society, Inc., USA; Prospects for Improved Forecasts of Weather and Short-Term Climate Variability on Subseasonal (2-Week to 2-Month) Times Scales; November 2002; Volume 23, pp. 128; In English; Also announced as 20030017775; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The purpose of this study is to examine the impact of sub-seasonal sea surface temperature (SST) variability on the simulation of the seasonal mean extra-tropical circulation using a state-of-the-art high resolution atmospheric general circulation model (AGCM). The format is a case study for January through March 1989 (JFM89) and the primary emphasis is on regional scales over North America. The SST boundary conditions in the AGCM simulations were prescribed using observed weekly data. Experiments were made in which the week-to-week (sub-seasonal) SST variability was suppressed. In terms of the largest spatial scales, the sub-seasonal SST variability has only a modest impact; however, statistically significant modifications to the 500 mb height anomalies over North America were detected. Consistent with these changes in the height field, the seasonal mean North American rainfall anomalies were particularly sensitive to the sub-seasonal SST variations, especially over the Pacific Northwest.

Two possible mechanisms for this sensitivity were investigated with additional AGCM experiments and model diagnostics. The first mechanism, referred to as a "stochastic" effect, is defined by the hypothesis that the week-to-week SST variability only serves to enhance the amplitude of tropical precipitation variability, which, in turn, modifies the mid-latitude response. With this "stochastic" effect, the details of the sub-seasonal SST evolution do not matter. In contrast, the second mechanism is a "deterministic" effect in that the details of the evolution of the sub-seasonal SST matter. The experiments presented here indicate that the "stochastic" effect is small and that the details of the sub-seasonal SST produce significant differences. This conclusion is supported by experiments with very large ensembles using a somewhat lower resolution AGCM and a non-linear barotropic model. Finally, some implications of these results for real time forecasting are discussed.

Author

*Sea Surface Temperature; Simulation; Tropical Regions; Forecasting; Atmospheric General Circulation Models; Annual Variations*

**20030017807** National Centers for Environmental Prediction, Washington, DC USA

**Simulation of Time Mean Tropical Circulation and Its Variations in AMIP Runs Using Different Versions of the Operational NCEP Global Model**

Saha, Suranjana, National Centers for Environmental Prediction, USA; Prospects for Improved Forecasts of Weather and Short-Term Climate Variability on Subseasonal (2-Week to 2-Month) Times Scales; November 2002; Volume 23, pp. 129; In English; Also announced as 20030017775; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

A primary reason to believe there could be predictability beyond week-2 would be skill in forecasting organized transient tropical convection, such as the MJO which has time scales of 20-70 days. Assuming that the forecast should be made by a model (GCM), it has been a perennial frustration to modelers that GCM's do not simulate, let alone predict, phenomena like the MJO very well at long leads. At NCEP we are revisiting this topic anew, and have made many 1 year (2001) AMIP style model integrations. Three different horizontal resolutions (T62, T126 and T170), as well as three different vertical resolutions (L28, L42 and L64) have been combined with two different convective parameterization schemes (SAS and RAS). In all 9 such runs have been made. All experiments start on 15 Dec 2000 and end on 31 Dec 2001 ... 382 days. The time series for most fields have been saved for 0Z, 6Z, 12Z and 18Z....total of  $382 \times 4 = 1528$  time levels. Monthly means for all diabatic heating components as well as other important 3\_D quantities have been saved and is available to the community. For a reality check we used three operational NCEP analyses for the same 1 year period, specifically the high resolution T170L42 GDAS, the low resolution T62L28 GDAS, and the T62L28 CDAS. The question is how well do we simulate upper level divergence or tropical velocity potential anomalies and how do they depend on the convection scheme, horizontal or vertical resolution. Fortunately, the year 2001 had strong MJO activity. Leaving aside questions of short range forecast skill (first 2 weeks), we studied the amplitude of the anomalies, and the phase speed or period in the extended integration. We found that most model versions had an acceptable strength of velocity potential anomalies, but the westerly phase speed of the MJO appear to be too low in nearly all model versions, except in a few. Study of the diabatic heating fields has yet to establish whether the results are merely fortuitous, or correct for the right reason.

Author

*Tropical Regions; Time Series Analysis; Simulation; Atmospheric Circulation; Forecasting*

**20030017808** National Oceanic and Atmospheric Administration, Climate Diagnostics Center, Boulder, CO USA

**An Empirical Estimate of Subseasonal Predictability**

Newman, Matt, National Oceanic and Atmospheric Administration, USA; Prospects for Improved Forecasts of Weather and Short-Term Climate Variability on Subseasonal (2-Week to 2-Month) Times Scales; November 2002; Volume 23, pp. 130; In English; Also announced as 20030017775; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Linear inverse models (LIMs) suitable for studies of atmospheric extratropical variability and predictability on longer than weekly time scales have been constructed for each season of the year, using atmospheric observations of the past 30 years. Notably, these empirical-dynamical models include tropical diabatic heating as a predicted model variable rather than as a forcing, and also include, in effect, the feedback of the extratropical weather systems on the more slowly varying circulation. The models are capable of reproducing both lagged covariance statistics from independent data and the development of individual streamfunction and tropical heating anomalies. In fact, week 2 predictions by the models have skill comparable to that of the NCEP MRF ensemble mean forecasts (forecasts are available at <http://www.cdc.noaa.gov/lim>). Comparison to a 20-year dataset of "reforecasts" using the early 1998 operational version of the MRF further shows that the LIM has notably higher week 3 skill year-round, and may even have higher week 2 skill during spring. The LIM also has much greater skill than the MRF for forecasts of tropical diabatic heating. Theoretical predictability limits derived for the LIM suggest that the model has useful mean forecast skill at forecast lead

times of between three and five weeks, depending upon both season and geographical region. Some initial atmospheric states which result in strong deterministic growth are associated with greater predictability because of a relatively high signal to noise ratio, although these states too have strong seasonal dependence. Our analysis further suggests that without inclusion of tropical heating, weekly averages may be predictable between about 1-2 weeks in the extratropics, but with tropical heating included, they may be predictable as far as 5- 7 weeks ahead. Sensitivity of streamfunction anomaly growth to both the strength and location of tropical diabatic heating anomalies is shown to shift from the central Pacific in winter to the West Pacific and Indian oceans in summer. Such optimal anomaly growth is related not only to ENSO but also to tropical intraseasonal variability. These results also have important implications for the development of persistent anomalies, such as North American heat waves and droughts.

Author

*Numerical Analysis; Predictions; Seasons; Anomalies; Forecasting; Temperate Regions*

**20030017809** NASA Goddard Space Flight Center, Greenbelt, MD USA

**Role of Satellite Rainfall Information in Improving Understanding of the Dynamical Link Between the Tropics and Extratropics Prospects of Improved Forecasts of Weather and Short-Term Climate Variability on Sub-Seasonal Time Scales**

Hou, Arthur Y., NASA Goddard Space Flight Center, USA; Prospects for Improved Forecasts of Weather and Short-Term Climate Variability on Subseasonal (2-Week to 2-Month) Times Scales; November 2002; Volume 23131-132, pp. 131-132; In English; Also announced as 20030017775; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

The tropics and extratropics are two dynamically distinct regimes. The coupling between these two regimes often defies simple analytical treatment. Progress in understanding of the dynamical interaction between the tropics and extratropics relies on better observational descriptions to guide theoretical development. However, global analyses currently contain significant errors in primary hydrological variables such as precipitation, evaporation, moisture, and clouds, especially in the tropics. Tropical analyses have been shown to be sensitive to parameterized precipitation processes, which are less than perfect, leading to order-one discrepancies between estimates produced by different data assimilation systems. One strategy for improvement is to assimilate rainfall observations to constrain the analysis and reduce uncertainties in variables physically linked to precipitation. At the Data Assimilation Office at the NASA Goddard Space Flight Center, we have been exploring the use of tropical rain rates derived from the TRMM Microwave Imager (TMI) and the Special Sensor Microwave/ Imager (SSM/I) instruments in global data assimilation. Results show that assimilating these data improves not only rainfall and moisture fields but also related climate parameters such as clouds and radiation, as well as the large-scale circulation and short-range forecasts. These studies suggest that assimilation of microwave rainfall observations from space has the potential to significantly improve the quality of 4-D assimilated datasets for climate investigations (Hou et al. 2001). In the next few years, there will be a gradual increase in microwave rain products available from operational and research satellites, culminating to a target constellation of 9 satellites to provide global rain measurements every 3 hours with the proposed Global Precipitation Measurement (GPM) mission in 2007. Continued improvements in assimilation methodology, rainfall error estimates, and model parameterizations are needed to ensure that we derive maximum benefits from these observations.

Author

*Data Systems; Error Analysis; Forecasting; Precipitation (Meteorology); Remote Sensing; Variability*

**20030017810** NASA Goddard Space Flight Center, Greenbelt, MD USA

**Predictability Associated with Land Surface Moisture States: Studies with the NSIPP System**

Koster, R. D., NASA Goddard Space Flight Center, USA; Suarez, M. J., NASA Goddard Space Flight Center, USA; Prospects for Improved Forecasts of Weather and Short-Term Climate Variability on Subseasonal (2-Week to 2-Month) Times Scales; November 2002; Volume 23, pp. 135-138; In English; Also announced as 20030017775; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

Hydrologists have long speculated that soil moisture information can be used to increase skill in monthly to seasonal forecast systems. For this to be true, though, three conditions must be satisfied: (1) an imposed initial soil moisture anomaly in the forecast system must have some memory, so that it persists into the forecast period; (2) the modeled atmosphere must respond in a predictable way to the persisted anomaly; and (3) the forecast model must correctly represent both the soil moisture memory and the atmospheric response as they occur in nature. In this short paper, we review some recent work at NSIPP (NASA Seasonal-to-Interannual Prediction Project) that addresses all three conditions.

Author

*Predictions; Soil Moisture; Earth Surface*

**20030017811** California Univ., San Diego, CA USA

**The Predictability of Soil Moisture and Near Surface Temperature Based on the Hindcasts of NCEP Seasonal Forecast Model**

Kanamitsu, Masao, California Univ., USA; Lu, Cheng-Hsuan, National Centers for Environmental Prediction, USA; Ebisuzaki, Wesley, National Centers for Environmental Prediction, USA; Schemm, Jae, National Centers for Environmental Prediction, USA; Prospects for Improved Forecasts of Weather and Short-Term Climate Variability on Subseasonal (2-Week to 2-Month) Times Scales; November 2002; Volume 23, pp. 139-141; In English; Also announced as 20030017775; Original contains color illustrations; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

Using the NCEP/DOE Reanalysis soil moisture analysis and the NCEP Seasonal Forecast System, the seasonal predictability of the soil moisture, and near surface temperature over the globe were examined. It is shown that the NCEP/DOE Reanalysis soil moisture is reasonably good over the USA compared to an independent soil moisture observation. This means that the current experiments are conducted under more realistic conditions in contrast to model-based studies performed in the past. Two sets of forecasts were made, one starting from climatological soil moisture as initial condition and the other starting from NCEP/DOE Reanalysis soil moisture. Each set is made of 10-member ensemble, 7-month integrations, 16 early Aprils as initial conditions for the 1979-1996 period. The predictability of the soil moisture was examined over several regions over the globe with different climatological characteristics (Fig. 1), and the results are presented in Fig.2. It is found that the prediction skill of soil moisture is very high over regions where there is little or less precipitation. Over these areas, the soil moisture evolution is largely determined by the evaporation process, and the model does an excellent job in predicting this process. In many of these relatively dry or low precipitation areas, model prediction surpasses the anomaly persistency forecast. Over temperate zones with more precipitation, and over tropical monsoon regions, the prediction skill of the soil moisture drops quickly in the first 3-4 months. Over these regions, the soil moisture evolves following the Markov process in which precipitation acts as a white noise forcing and the soil moisture decays exponentially. The time scale of this Markov process computed as a ratio between precipitation and potential evaporation showed that the time scale is particularly short over the monsoon regions and some temperate zones. Over all the regions noted above, the forecast starting from climatological soil moisture is very poor, indicating that the soil moisture anomalies cannot be generated by model precipitation or by the model evaporation. From a practical point of view, the soil moisture initial condition is essential in making seasonal prediction over these areas. In contrast, the characteristics are very different over tropical South America. The forecast starting from climatological soil moisture quickly catches up to the forecast skill of initial soil moisture as well as the anomaly persistency. Particularly in the Northeast region of South America, the anomaly persistency becomes the worst forecast after 4 months. Over these areas, SST forcing determines the precipitation anomaly over land, and subsequently forces the soil moisture evolution. The effect of initial soil moisture information tends to disappear after 3-4 months over these areas. The near surface temperature anomaly forecast is closely related to the soil moisture anomaly forecast. The correlation, however, is not perfect. Thus the near surface temperature forecast skill is lower than the soil moisture forecast skill. Our analysis shows that the skill of predicting latent heat flux is lower than that of the soil moisture, and that of the surface temperature is even lower. This is because additional physical processes, such as cloudiness and near surface atmospheric conditions are also involved in determining the near surface air temperature. The abundance of near surface temperature observation allows us to verify our hindcasts with independent data that are not used in the NCEP/DOE Reanalysis. The verification of temperature made against CD433 data clearly indicated that the use of the NCEP/DOE reanalysis soil moisture initial condition truly improved the forecasts. For better prediction of soil moisture and near surface temperature during summer, it is important that the soil moisture initial condition is accurately specified and the model produces better precipitation forecast. Unfortunately, these two requirements are very difficult to satisfy, and further advances in observational and modeling studies are needed. Independent measure of the soil moisture is also extremely important to eliminate any model dependent result. In this regard, satellite observation that provides soil moisture measurement is becoming available, and the use of such data is strongly encouraged.

Derived from text

*Predictions; Soil Moisture; Surface Temperature; Hindcasting; Forecasting; Atmospheric Models; Meteorology*

**20030017812** NASA Goddard Space Flight Center, Greenbelt, MD USA

**The Impact of Land Initialization and Assimilation on Climate Predictability and Prediction**

Schlosser, C. Adam, Maryland Univ., USA; Milly, P. C. D., Geological Survey, USA; Dirmeyer, Paul A., Maryland Univ., USA; Mocko, David, Science Applications International Corp., USA; Prospects for Improved Forecasts of Weather and Short-Term Climate Variability on Subseasonal (2-Week to 2-Month) Times Scales; November 2002; Volume 23, pp. 142; In English; Also announced as 20030017775; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Analysis will be presented which explores the impact of land conditions on monthly to seasonal climate simulations in a variety of atmospheric general circulation models (AGCMs). In one set of experiments, the Geophysical Fluid Dynamics

Laboratory (GDFL) AGCM is used to explore the nature of soil-moisture predictability and associated climate predictability as an initial value problem. For another set of experiments, the Center for Ocean Land Atmosphere (COLA) and the Goddard Earth Observing System 2 (GEOS-2) AGCMs are used to investigate the impact of realistic snow initialization and assimilation in retrospective climate forecasts for the northern hemisphere spring (March-June).

Derived from text

*Atmospheric General Circulation Models; Climate; Air Water Interactions; Diagnosis; Earth Surface; Forecasting*

**20030017813** Maryland Univ., Center for Ocean-Land-Atmosphere Studies, College Park, MD USA

**Three Modes of Climate Drift in Coupled Land-Atmosphere Systems**

Dirmeyer, Paul A., Maryland Univ., USA; Prospects for Improved Forecasts of Weather and Short-Term Climate Variability on Subseasonal (2-Week to 2-Month) Times Scales; November 2002; Volume 23, pp. 143; In English; Also announced as 20030017775; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Three different modes of climate drift have been identified in a coupled land-atmosphere climate model. The fastest growing error modes are those associated with errors in the atmospheric initial conditions. The signature of these modes are evident as drift in the time series of land surface state variables. Second is the climate drift associated with systematic errors on the scale from weeks to seasons. This drift is dominated by the error modes with the largest saturation amplitude. This drift tends to erase the "information" in the anomalies in the land surface initial conditions, that would be expected to provide added predictability to medium-range to seasonal forecasts. Third, there is drift due to the coupled error mode, where systematic errors in the atmospheric physics can push the land surface state beyond its "observed" range or variability over seasons-years. This mode is evident in the clear stratification of skill (both in simulation of mean states, and prediction of anomalies) between DSP-type experiments (1-4 month simulations), and corresponding AMIP or C20C experiments (multi-decadal simulations). The coupled drift mode is relatively weak during winter, but evident during all other seasons. Examples of the three kinds of drift will be shown in global climate simulations, and methods for ameliorating these types of drift will be discussed.

Author

*Atmospheric Physics; Climate Models; Climatology; Variability; Periodic Variations; Meteorology; Forecasting*

**20030017814** NASA Goddard Space Flight Center, Greenbelt, MD USA

**GCM Simulation of the Large-scale North American Monsoon Including Water Vapor Tracer Diagnostics**

Bosilovich, Michael G., NASA Goddard Space Flight Center, USA; Schubert, Siegfried D., NASA Goddard Space Flight Center, USA; Sud, Yogesh, NASA Goddard Space Flight Center, USA; Walker, Gregory K., NASA Goddard Space Flight Center, USA; Prospects for Improved Forecasts of Weather and Short-Term Climate Variability on Subseasonal (2-Week to 2-Month) Times Scales; November 2002; Volume 23, pp. 144-148; In English; Also announced as 20030017775; Original contains color illustrations; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

In this study, we have applied GCM water vapor tracers (WVT) to simulate the North American water cycle. WVTs allow quantitative computation of the geographical source of water for precipitation that occurs anywhere in the model simulation. This can be used to isolate the impact that local surface evaporation has on precipitation, compared to advection and convection. A 15 year 1 deg, 1.25 deg. simulation has been performed with 11 global and 11 North American regional WVTs. Figure 1 shows the source regions of the North American WVTs. When water evaporates from one of these predefined regions, its mass is used as the source for a distinct prognostic variable in the model. This prognostic variable allows the water to be transported and removed (precipitated) from the system in an identical way that occurs to the prognostic specific humidity. Details of the model are outlined by Bosilovich and Schubert (2002) and Bosilovich (2002). Here, we present results pertaining to the onset of the simulated North American monsoon.

Author

*Water Vapor; Monsoons; North America; Diagnosis*

**20030017815** National Oceanic and Atmospheric Administration, Climate Diagnostics Center, Boulder, CO USA

**Storm Track Prediction**

Whitaker, Jeffrey S., National Oceanic and Atmospheric Administration, USA; Hamill, Thomas M., National Oceanic and Atmospheric Administration, USA; Prospects for Improved Forecasts of Weather and Short-Term Climate Variability on Subseasonal (2-Week to 2-Month) Times Scales; November 2002; Volume 23, pp. 151-152; In English; Also announced as 20030017775; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

The transition between a 'climate' and a 'weather' forecast can be defined to occur at the point in the forecast when individual synoptic-scale, 'weather' producing systems can no longer be skillfully predicted. At this point, one must begin issuing forecasts of the statistics of synoptic-scale storms, i.e. the storm tracks, instead of forecasts of the synoptic-scale storms themselves. Storm

tracks are predictable as long as the large-scale, low-frequency flow modulates the storm tracks and remains predictable. In this study we have utilized an "MRF reforecast dataset" (<http://www.cdc.noaa.gov/~jsw/refcst>), consisting of 23 years of forecasts with a recent version of NCEP's medium range forecast model, to assess the predictability of storm tracks out to week three. Coherent, predictable modes of storm track variability are identified, and used as a basis for producing calibrated, quantitative precipitation probability forecasts (QPPF) in week two.

Derived from text

*Accumulations; Climatology; Forecasting; Predictions; Storms; Winter*

**20030017816** NASA Goddard Space Flight Center, Greenbelt, MD USA

**Extreme Weather Events and Their Relationship to Low Frequency Teleconnection Patterns**

Chang, Yehui, NASA Goddard Space Flight Center, USA; Schubert, Siegfried, NASA Goddard Space Flight Center, USA; Prospects for Improved Forecasts of Weather and Short-Term Climate Variability on Subseasonal (2-Week to 2-Month) Times Scales; November 2002; Volume 23, pp. 153-157; In English; Also announced as 20030017775; Original contains color illustrations; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

A new method for identifying the structure and other characteristics of extreme weather events is introduced and applied to both model simulations and observations. The approach is based on a linear regression model that links daily extreme precipitation amounts for a particular point on the globe to precipitation and related quantities at all other points. We present here some initial results of our analysis of extreme precipitation events over the United States, including how they are influenced by ENSO and various large-scale teleconnection patterns such as the PNA. The results are based on simulations made with the NASA/NCAR AGCM (Lin and Rood 1996). The quality of the simulated climate for the NASA/NCAR AGCM forced with observed SSTs is described in Chang et al. (2001). The runs analyzed here consist of three 20-year runs forced with idealized cold, neutral and warm ENSO SST anomalies (superimposed on the mean seasonal cycle of SST). The idealized warm or cold SST anomalies are fixed throughout each 20-year simulation and consist of the first EOF (+/- 3 standard deviations) of monthly SST data. Comparisons are made with the results obtained from a similar analysis that uses daily NOAA precipitation observations (Higgins et al. 1996) over the USA and NCEP/NCAR reanalysis data for the period 1949-1998.

Author

*Teleconnections (Meteorology); Standard Deviation; Simulation; Mathematical Models; Climate; Anomalies*

**20030017817** Maryland Univ., Center for Ocean-Land-Atmosphere Studies, College Park, MD USA

**The Relationship Between the Classic PNA Pattern and the ENSO-Forced Pattern on Time Scales From Daily to Seasonal**

Straus, David M., Maryland Univ., USA; Shukla, J., Maryland Univ., USA; Prospects for Improved Forecasts of Weather and Short-Term Climate Variability on Subseasonal (2-Week to 2-Month) Times Scales; November 2002; Volume 23, pp. 158; In English; Also announced as 20030017775; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

From the perspective of seasonal mean predictability, one can distinguish between the SST-forced external response and chaotic internal variability. The former (latter) leads to predictable (unpredictable) components of seasonal mean fields. A large number of ensemble seasonal historical forecasts made with the COLA AGCM (forced by observed SSTs) for many winters are used to distinguish patterns of internal variability (including the PNA pattern of Wallace and Gutzler) from true forced response patterns, such as the dominant ENSO-forced pattern. The former can be identified from EOF analysis of the deviations of seasonal means about the ensemble means, and from long integrations using climatologically varying SSTs. The latter can be identified from EOF analysis of the ensemble means or from the pattern which optimizes the "signal to noise" ratio. A number of consistency checks are used to confirm the validity of these identifications. The presence of internal variability patterns in seasonal means is thought to be due in large part to statistical residuals of shorter time episodes. Information on the strength and duration of these episodes can be gleaned from projections of daily and 5-day mean fields from individual integrations onto internal variability patterns. Comparison to similar projections onto the external patterns yields information on the shorter time scale manifestations of the forced response. Internal variability can depend on the state of SST forcing, yielding probability shifts in for example the PNA pattern between warm and cold ENSO winters. In addition, changes in the nature of ENSO itself during the past 50 years have led to subtle changes in the forced patterns, and the degree to which they are distinguishable from internal variability. These issues will also be addressed using large numbers of COLA AGCM ensemble integrations.

Author

*Southern Oscillation; El Nino; Predictions; Forecasting*

**20030017818** Georgia Inst. of Tech., Atlanta, GA USA

**Assessment of Midlatitude Subseasonal Variability in NASA/GSFC General Circulation Models**

Black, Robert X., Georgia Inst. of Tech., USA; Robinson, Dennis P., Georgia Inst. of Tech., USA; McDaniel, Brent A., Georgia Inst. of Tech., USA; Prospects for Improved Forecasts of Weather and Short-Term Climate Variability on Subseasonal (2-Week to 2-Month) Times Scales; November 2002; Volume 23, pp. 159-162; In English; Also announced as 20030017775; Original contains color illustrations; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

The success of short-term climate prediction efforts is critically dependent upon the veracity with which atmospheric general circulation models (GCMs) are able to simulate the atmospheric circulation. A minimum expectation is that GCMs employed are capable of realistically representing important aspects of the current climate. Regional climate is strongly influenced by second order atmospheric circulation features such as storm track variability and anomalous weather regimes, both of which are dynamically linked to the midlatitude jet stream and are associated with alterations in surface weather. A proper representation of the behavior of anomalous weather regimes and storm tracks is essential for reliable climate simulations. A detailed assessment of short-term climate variability thus provides an important benchmark for a climate model. We perform an exploratory study of storm tracks and anomalous weather regimes in extended integrations of NASA/GSFC GCMs. This includes intercomparisons of the representation of these natural phenomena in AMIP-type simulations of NASA/NCAR (NASCAR) and Aries (NSIPP) models. Specifically, we employ the AMIP fvccm3-1.2.0 NASCAR run and the ens05 AMIP run of NSIPP 1. We diagnose their statistics, structure, and dynamical characteristics and contrast these results to parallel observational reanalyses (NCEP/NCAR) to isolate systematic errors. Long-term goals include: (a) determining the extent to which the models are able to replicate observed characteristics of the phenomena and (b), in cases where a specific shortcoming is identified, performing targeted dynamical diagnoses aimed at deducing the underlying physical reasons for the systematic errors.

Author

*Atmospheric General Circulation Models; Weather; Variability; Simulation; Predictions; Climate Models*

**20030017819** Maryland Univ., Dept. of Meteorology, College Park, MD USA

**Diagnostics of Climate Variability and Trend Using Potential Vorticity Maps**

Cai, Ming, Maryland Univ., USA; Kalnay, Eugenia, Maryland Univ., USA; Prospects for Improved Forecasts of Weather and Short-Term Climate Variability on Subseasonal (2-Week to 2-Month) Times Scales; November 2002; Volume 23, pp. 163; In English; Also announced as 20030017775; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Daily pressure fields on a constant potential vorticity (PV) surface ( $PV = 2.5$  unit) are analyzed using NCEP/NCAR reanalysis II (1979-2000) dataset. Potential vorticity folding indexes (PVFI) are developed to measure the mean latitudinal position, area, and intensity of the polar front zone over the Northern Hemisphere. It is found that these indexes closely related to the interannual and decadal variability of the cold air temperature anomalies over the high latitudes (north of 40 degrees). In general, these indexes are negatively correlated with the cold air temperature anomalies near the surface. The interannual variability of these indexes has a strong QBO signal. These indexes also exhibit strong interdecadal variability. Between early 80s and early 90s, these indexes all exhibit a negative trend, accompanied with which is a warming trend in both cold/warm surface air temperature anomalies. During last 5 years of 90s, these indexes have a positive trend superimposed on a QBO-like interannual variability. Interestingly, the surface air temperature anomalies continuously exhibit a warm trend while their interannual variability follows the interannual variability of PVFI. This seems to suggest that we are beginning to observe a separation between the climate trend induced by change in circulation and that induced by other factors, such as anthropogenic factors.

Author

*Climate Change; Variability; Atmospheric Temperature; Pressure Distribution*

**20030017820** National Centers for Environmental Prediction, Camp Springs, MD USA

**Systematic Errors and Surface Fluxes in the NCEP Global Model**

White, Glenn, National Centers for Environmental Prediction, USA; Prospects for Improved Forecasts of Weather and Short-Term Climate Variability on Subseasonal (2-Week to 2-Month) Times Scales; November 2002; Volume 23, pp. 164-169; In English; Also announced as 20030017775; No Copyright; Avail: CASI; A02, Hardcopy; A02, Microfiche

This paper reflects the following assumptions: a) Improving the atmospheric analysis/forecast systems currently used for 0-15 day numerical weather prediction and coupling them to complex land and ocean analysis/forecast systems can significantly improve 15-60 day forecasts. b) Improving either the 0-15 or 15-60 day forecasts will usually improve the other. c) Investigating the shortcomings of the current forecast system is a key ingredient in improving forecasts. d) More realistic physics and tropics are required for successful 15-60 day forecasts than for 0-7 day mid-latitude forecasts. We may well not know the physics in the

actual atmosphere as well as we need to produce successful 15-60 day forecasts. e) 15-60 day and seasonal forecasts need for model verification and diagnosis a reanalysis consistent with the forecast model.

Derived from text

*Systematic Errors; Atmospheric Circulation; Tropical Regions; Time Measurement; Numerical Weather Forecasting*

**20030017821** NASA Goddard Space Flight Center, Greenbelt, MD USA

**Configuration and Intraseasonal Duration of Interannual Anomalies of the Great Plains Low-Level Jet**

Helfand, H. M., NASA Goddard Space Flight Center, USA; Prospects for Improved Forecasts of Weather and Short-Term Climate Variability on Subseasonal (2-Week to 2-Month) Times Scales; November 2002; Volume 23, pp. 170-171; In English; Also announced as 20030017775; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Despite the fact that the low-level jet of the southern Great Plains (the GPLLJ) of the U.S. is primarily a nocturnal phenomenon that virtually vanishes during the daylight hours, it is one of the most persistent and stable climatological features of the low-level continental flow during the warm-season months, May through August. We have used significant-level data to validate the skill of the GEOS-1 Data Assimilation System (DAS) in realistically detecting this jet and inferring its structure and evolution. We have then carried out a 15-year reanalysis with the GEOS-1 DAS to determine its climatology and mean diurnal cycle and to study its interannual variability. Interannual anomalies of the meridional flow associated with the GPLLJ are much smaller than the mean diurnal fluctuations, than random intraseasonal anomalies, and than the mean wind itself. There are three maxima of low-level meridional flow variance over the Great Plains and the Gulf of Mexico: a 1.2 m<sup>2</sup> s<sup>-2</sup> peak over the southeast Texas, to the east and south of the mean velocity peak, a 1.0 m<sup>2</sup> s<sup>-2</sup> peak over the western Gulf of Mexico, and a .8 m<sup>2</sup> s<sup>-2</sup> peak over the upper Great Plains (UGP), near the Nebraska/South Dakota border. Each of the three variance maxima corresponds to a spatially coherent, jet-like pattern of low-level flow interannual variability. There are also three dominant modes of interannual variability corresponding to the three variance maxima, but not in a simple one-to-one relationship. Cross-sectional profiles of mean southerly wind over Texas remain relatively stable and recognizable from year to year with only its eastward flank showing significant variability. This variability, however, exhibits a distinct, biennial oscillation during the first six to seven years of the reanalysis period and only then. This intermittent biennial oscillation (IBO, one of the three modes discussed in the previous paragraph) in the lowlevel flow is restricted to the region surrounding eastern Texas and is also evident in the NCEP/NCAR reanalysis data set from about 1978 to 1985 or 1986 and again from 1995 to 2000. It is evident as well in surface pressure in both the GEOS-1 and NCEP/NCAR sets. The interannual anomalies do not necessarily persist uniformly throughout an entire season, but can fluctuate from one part of the season to the next. To estimate the characteristic sub-seasonal time scales for coherence of these fluctuations, we have taken the weekly anomaly of low-level wind at each point of the domain from the climatological average for that given point and that given week of the season and computed the covariance of its fluctuations over all weeks and over all years with the weekly climatological anomaly of the meridional wind at each of the three reference points discussed above. The typical duration of a coherent interannual anomaly within a given warm season increases with decreasing latitude from 2 to 3 weeks over the UGP, to 6 to 7 weeks over eastern Texas. Coherence over the western Gulf of Mexico is intermediate between the two with a typical duration of 4 to 5 weeks. There appears to be evidence that the interannual anomalies over Texas the Gulf propagate to the UGP after a week and those over the Gulf propagate there after 2 to 3 weeks. There also appears to be some reverse propagation of interannual anomalies over the UGP to Texas and to the Gulf after a period of about one week. The interannual anomalies in southerly flow over eastern Texas seem to correlate well with interannual anomalies of surface temperature and (negative) ground wetness and over western Texas.

Author

*Anomalies; Climatology; Jet Streams (Meteorology); Meridional Flow; Moisture Content; Surface Temperature; Wind (Meteorology)*

**20030017836** Instituto Nacional de Pesquisas Espaciais, Sao Jose dos Campos, Brazil

**Variability and Predictability of the Sea Surface Temperature in the Tropical Atlantic *Variabilidade e Previsibilidade da Temperatura da Superfície do Mar no Atlantico Tropical***

Andreoli, Rita Valeria, Instituto Nacional de Pesquisas Espaciais, Brazil; 2003; 230p; In Portuguese Report No.(s): INPE-9557-TDI/833; No Copyright; Avail: CASI; A11, Hardcopy; A03, Microfiche

The interannual and decadal variability of the sea surface temperature (SST) and the associated atmospheric circulation in the Tropical Atlantic (TA) for the 1945-1993 period is studied using the empirical orthogonal function and composite techniques. In addition, statistical models based on the canonical correlation analysis are constructed to forecast the SST anomalies (SSTA) in this sector. The equatorial and dipole patterns are the dominant modes at the interannual and decadal time scales. For the interannual time scale, the dipole mode is stronger during the 1949-1961 period and the equatorial mode, during the 1962-1977 and 1978-1989 periods. These modes are directly forced by fluctuations in the surface winds. The equatorial and dipole modes

are related to each other, such that one can evolve into the other and vice-versa at interannual and decadal time scales. As part of the evolution, the SSTA in the band between 15 deg N and 15 deg S exhibit meridional displacements, which are, in turn, related to the duration and intensity of the equatorial and dipole modes. Both, the dipole and equatorial modes show strong seasonality. The dipole mode is more frequent during the February-May with maximum occurrence in March and the location and magnitude of its centers show seasonal differences. The location of equatorial mode is approximately the same throughout the year and this mode is more frequent during June-November period, with maximum in July. The monthly forecasts of the SST for March to June with the predictors of the TA and Equatorial Pacific (PE) and 3-6 month lags have better skill in the North Atlantic region (RAN) than in the South Atlantic (RAS) and Equatorial Atlantic (RAE) regions. This implies monthly predictors from November to March. The forecast skill for the RAS and RAE is not improved with the inclusion of the predictors of the PE besides the TA. This may reflect the fact that the SST variability in these regions is related to the local factors.

Author

*Sea Surface Temperature; Atmospheric Circulation; Functions (Mathematics); Analysis (Mathematics); Mathematical Models; Atlantic Ocean; Air Water Interactions; Ocean Dynamics*

**20030017842** Massachusetts Inst. of Tech., USA

**Collaborative Research: Atlantic Ocean Tropical/Subtropical Processes from Seasonal to Decadal Time Scales: Model/Data, Model/Model Comparison and Model/Data Synthesis Through Assimilation** *Annual Report, 1 Jan. 2002 - 28 Feb. 2003*

Malanotte-Rizzoli, Paola, Massachusetts Inst. of Tech., USA; [2003]; 1p; In English

Contract(s)/Grant(s): NAG5-11746; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The effort of this first year of research has been focused on the assimilation of TOPEX/Poseidon altimetric data into a primitive equation model of the Atlantic tropical/subtropical circulation. A reduced-rank, stationary Kalman filter has been constructed to assimilate the altimetric sea surface height anomaly (SHA) into the model. The goal is to assess how the inter-hemispheric transports between the Atlantic subtropics and tropics are affected by the assimilation and how the subsurface thermocline structure, and its variability, is dynamically constrained by the SHA. The model is a reduced-gravity primitive equation GCM of the upper Atlantic Ocean between 30 S and 30 N. The assimilation scheme is an approximation to the extended Kalman filter in which the error covariances of the state estimates are calculated only in a reduced-dimension subspace. The subspace is defined by the leading empirical orthogonal functions calculated from an unconstrained model calculation. Both an identical twin experiment using simulated SHA observations and assimilation of the real TOPEX data were performed. Results from the twin experiments demonstrate the ability of the method to constrain the ocean circulation and the subsurface temperature structure. The impact on the subsurface temperature structure of TOPEX assimilation was assessed using data from expandable bathythermographs. This showed a substantial improvement in the estimated temperature variability only within 13 degrees in latitude around the equator. The impact of TOPEX SHA assimilation on zonally integrated meridional transport across different latitudes was also estimated. Again within 13 degrees from the equator both the mean amplitude and interannual variability of the surface and subsurface transports were significantly enhanced, while the transports were insensitive to the assimilation in the subtropics.

Derived from text

*Atlantic Ocean; Tropical Regions; TOPEX; Data Acquisition; Annual Variations; Mathematical Models; Poseidon Satellite; Oceanography*

## 48

### OCEANOGRAPHY

*Includes the physical, chemical and biological aspects of oceans and seas; ocean dynamics, and marine resources. For related information see also 43 Earth Resources and Remote Sensing.*

**20030014890** Tartu Univ., Inst. of Geology, Tartu, Estonia

**Cooling of the Kardla Impact Crater, 1, The Mineral Parasequence Observations**

Versh, E., Tartu Univ., Estonia; Joeleht, A., Tartu Univ., Estonia; Kirsimae, K., Tartu Univ., Estonia; Plado, J., Tartu Univ., Estonia; Impact Cratering: Bridging the Gap Between Modeling and Observations; 2003, pp. 69; In English; Also announced as 20030014839; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Kinetic energy released to the target by a meteorite impact results in the heating-to-melting and vaporization of the projectile and target rocks, which then start to cool to the ambient conditions. In dry environments (e.g. Moon) the heat loss occurs mainly by conduction and radiation transfer. If the water is present at the crater site as on Earth and supposedly on Mars, then the cooling

can include also convective heat transfer by hydrothermal circulation systems. Evidences of impact-induced hydrothermal activity have been found at many terrestrial craters, and it is suggested for extraterrestrial craters as well. Cooling and development of such impact-induced hydrothermal systems can be recognized by the means of: (1) mineralogical/ fluid inclusion studies, and (2) by impact and geothermal modeling.

Author

*Cooling; Craters; Kinetic Energy; Impact Fusion; Meteorite Collisions; Vaporizing; Heating; Melting*

**20030016710** Swedish Water and Air Pollution Research Lab., Stockholm, Sweden

**Occurrence and Effects of Selenium in the Environment: A Literature Review**

Parkman, H.; Hultberg, H.; Sep. 2002; 36p; In English

Report No.(s): PB2003-102618; IVL-B-1486; Copyright; Avail: National Technical Information Service (NTIS), Microfiche

The literature review has revealed that the chemical forms of Hg and Se are important in the toxicology and the interactions between mercury and selenium. The research summarised in the report clearly demonstrates that there is an effect on fish. However, no literature data was found on the lastingness of the inhibiting effect of Se on Hg accumulation. The data on retention of Se in the water mass indicates that the removal of Se is a fairly slow process in oligotrophic clearwater lakes, while incorporation of Se in primary producers of eutrophic lakes causes selenium losses to the sediments. The literature shows that most of the selenium in the fish is taken up from the food, and that Selenium is effectively biomagnified. It also seems like fish are as sensitive as lower organisms for certain Se-exposure. Finally, the known toxic effects thresholds for selenium impacts on food-chain organisms are much higher than the dietary effect levels for fish.

NTIS

*Mercury (Metal); Selenium; Water Pollution; Toxicology*

**20030017755** National Oceanic and Atmospheric Administration, Pacific Marien Environmental Lab., Seattle, WA USA

**Atlas Module Temperature Bias Due to Solar Heating**

A'Hearn, P. N.; Freitag, H. P.; McPhaden, M. J.; Oct. 2002; In English; This document is color dependent and/or in landscape layout. It is currently available on CD-ROM and paper only

Report No.(s): PB2003-101593; NOAA/TM/OAR/PMEL-121; No Copyright; Avail: National Technical Information Service (NTIS)

Some near-surface temperature measurements from Next Generation Autonomous Temperature Line Acquisition Systems (NX ATLAS) moorings between 1996 and 2001 have been found to be at times biased by solar heating. The Bias is maximum near the sea surface around noon local time and has been observed at depths down to 75 m. Sea surface temperature sensors mounted immediately beneath the buoy at 1 m are not exposed to direct sunlight and thus not subject to similar solar heating. The bias is estimated to have a typical maximum of about 0.13 deg C at 20 m, the depth of the shallowest sensor on most moorings. Temperature sensors at 7 m and 10 m on some specially instrumented moorings may have larger biases. Modifications to the instrumentation and deployment procedures have reduced solar heating bias to 0.01 deg C or less. These improvements were first introduced in April 2000 and have been used on all moorings deployed since January 2001. The recovery of potentially biased instrumentation was completed in December 2001. A list of when and where data may be biased is given in the appendix.

NTIS

*Surface Temperature; Solar Heating; Ocean Surface; Maps*

## 51

### LIFE SCIENCES (GENERAL)

*Includes general research topics related to plant and animal biology (non-human); ecology; microbiology; and also the origin, development, structure, and maintenance, of animals and plants in space and related environmental conditions. For specific topics in life sciences see categories 52 through 55.*

**20030014708** New York Univ. Medical Center, New York, NY USA

**Using Genetic Means to Identify Factors That Affect Estrogen Receptor Function Annual Report**

Su, Laura; Garabedian, Michael J.; Jan. 2002; 52p; In English; Original contains color images

Contract(s)/Grant(s): DAMD17-98-1-8134

Report No.(s): AD-A409433; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

To identify novel components that affect the ER transcriptional response, we performed a genetic screen in yeast and identified RDII, a Rho guanine nucleotide dissociation inhibitor, as a positive regulator of ER transactivation. In contrast,

expression of constitutively active forms of RhoA, Rac1, and CDC42 decreases ER transcriptional activity, suggesting that Rho GDI increases ER transactivation by antagonizing ER inhibition by Rho GTPases. Our recent results indicate that the Rho GDI signal is transduced to ER by CBP/p300 through GRIPI- dependent and -independent pathways. Together, these findings establish Rho GTPases as important modulators of ER transcriptional activation by regulating of GRIPI and CPB coactivator activity. Our data suggest a complex relationship between ER transactivation and the Rho signaling pathways through modulation of receptor cofactors, which may have evolved to coordinate receptor-dependent gene expression with Rho-regulated events, such as cell migration. Our results also suggest that dysregulation of the Rho-ER axis may participate in cancer progression.

DTIC

*Estrogens; Gene Expression; Genetics; Nucleotides; Regulatory Mechanisms (Biology)*

**20030014709** Colorado Univ., Denver, CO USA

**Mechanisms of Growth Factor Attenuation of Cell Death in Chemotherapy Treated Breast Cancer Cells** *Annual Report*

Van Den Berg, Carla; Aug. 2002; 48p; In English

Contract(s)/Grant(s): DAMD17-99-1-9142

Report No.(s): AD-A409432; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

IGF-I receptor (IGF-IR) overexpression is a frequent aberration in found in breast tumors. IGF-IR activation may serve its greatest purpose in cancer cells by activating intracellular PI 3 -kinase and its downstream target Akt to convey proliferation and survival of breast cancer cells. In breast cancer cell lines, treatment with IGF-I results in IGF-IR activation and tyrosine phosphorylation of the IRS-I docking protein. The p85 subunit of PI 3-kinase then binds to IRS-I to activate downstream kinases such as Akt and p70S6 kinase. IGF-IR is an important target for development of new breast cancer interventions since its expression has been observed in 87% of breast cancer specimens. Breast cancer cells expressing IGF-IR undergo a robust proliferative response when exposed to the receptor's ligands. A great amount of research has focused on the effect of growth factor activation of Akt on breast cancer cell survival, with the belief that Akt must convey the majority of PI 3-kinase effects. My lab has studied the survival responses induced by IGF-I treatment of breast cancer cells and how these responses may be altered by cellular stress, including chemotherapy and radiation treatment induction of the p53 tumor suppressor protein.

DTIC

*Chemotherapy; Cells (Biology); Receptors (Physiology); Mammary Glands; Radiation Therapy*

**20030014710** National Inst. of Applied Sciences and Technology, Riadi Lab., Tunisia

**Framework for a Telemedicine Multilevel Diagnose System**

Karoui, Kamel; Sammouda, Rachid; Sammouda, Mohamed; Oct. 25, 2001; 6p; In English; Papers from the 23rd Annual International Conference of the IEEE engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom.,

Report No.(s): AD-A409431; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

We have designed a system that provides support for physicians regardless to their specializations. The main objective of the system is to ensure an accurate diagnosis to local unclassified patients. Our computerized support system takes as input clinical data collected and stored in an electronic patient record. It generates as output recommendation for therapeutic interventions and laboratory testing based on a four-level diagnosis process. The process starts with the diagnosis made by the local physician. which will be subject to a double verification by local and remote expert systems and finally approved by an appropriate remote specialist. We have constructed a telemedicine based system called SOS Specialist (SOSS) to achieve our objective. The SOSS will provide quality care to rural areas and also in the big cities where in some hospitals and other governmental organizations are still suffering from the lack of specialists in some very specific domains. A very attractive characteristic of the SOSS is that it has the capability to promote itself and that by adding the diagnosis of the appropriate specialist about the new cases to its local patient database furthermore it helps the physicians to update their knowledge outside their specializations.

DTIC

*Diagnosis; Expert Systems; Applications Programs (Computers); Clinical Medicine*

**20030014711** Hahnemann Medical Coll. and Hospital, Philadelphia, PA USA

**Emergence (From Chaos?) of Regulatory Order in the Transplanted Heart**

Kresh, J. Y.; Oct. 25, 2001; 4p; In English; Papers from 23rd Annual International Conference of the IEEE Engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom

Report No.(s): AD-A409429; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

There are many systems in nature in which a large assembly of autonomous parts (agents) interacting locally, in the absence of a high level global level controller, can give rise to highly coordinated and optimized behavior. The complex adaptive behavior of global structures that emerges is a consequence of nonlinear spatio-temporal interactions of local level processes or subsystems.

DTIC

*Heart Implantation; Autonomy; Optimization*

**20030014712** Albert Einstein Coll. of Medicine, Dept. of Pathology, Bronx, NY USA

**Molecular Markers of Metastasis in Ductal Mammary Carcinoma Annual Report, 1 Aug. 2001-31 Jul. 2002**

Achary, Patnala; Aug. 2002; 142p; In English; Original contains color images

Contract(s)/Grant(s): DAMD17-99-1-9055

Report No.(s): AD-A409427; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

The clinical outcome is generally positive for patients with node-negative breast carcinoma. In about 13% of those patients, however, the disease spreads, and they are at risk of death. Our goal is to develop DNA markers that could be reliably used to identify the ductal mammary carcinomas that are prone to develop metastasis. We compared DNA from normal cells and metastatic cells and also primary tumor cells and metastatic cells by representational difference analysis (RDA) method. We have isolated 15 metastasis associated DNA sequences (MADS), of which 3 were found to be associated with metastasis in breast cancer patient samples other than the index case that was used in RDA experiments. Screening of primary tumors using MADS as fluorescence in situ hybridization (FISH) probes showed that MADS-IX is homozygously lost in some of the tumor cells (3/50) of a primary tumor that had positive lymph nodes whereas it is not homozygously lost in any of the tumor cells (0/50) in the primary tumor that did not develop metastasis. Screening of additional cases is underway to determine if these results will be statistically significant.

DTIC

*Cancer; Lymphatic System; Mammary Glands; Metastasis*

**20030014713** Mount Sinai School of Medicine, New York, NY USA

**Bone Geometry as a Predictor of Tissue Fragility and Stress Fracture Risk Annual Report, 10 Sep. 2001-10 Sep 2002**

Jepsen, Karl J.; Oct. 2002; 11p; In English

Contract(s)/Grant(s): DAMD17-O1-1-O806

Report No.(s): AD-A409426; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Having a narrow tibia relative to body mass has been shown to be a major predictor of stress fracture risk and fragility. The reason for this phenomenon is not understood. Based on studies of genetically distinct inbred mouse strains, we found a reciprocal relationship between bone mass and bone quality, such that slender bones are associated with more damageable bone tissue. We postulate that a similar reciprocal relationship between bone mass and bone material properties exists in the human skeleton. The intriguing possibility that slender bones, like those we have demonstrated in animal models, may be composed of more damageable material than larger bones has not been considered. To test this hypothesis, we propose to determine whether whole bone geometry is a predictor of tissue fragility in the tibia from young male donors. Tissue damageability will be assessed from biomechanical testing of compact bone samples and correlated with measures of bone slenderness. Specimens will be subjected to detailed analyses of bone microstructure, composition, and microdamage content. In the second set of experiments, these analyses will be repeated for female donors to test for gender differences in tissue fragility. Further, we will test whether fragility in cortical bone is a predictor of fragility in cancellous bone. Finally, we will conduct ultrasound measurements to identify an ultrasound parameter that is sensitive to the presence of damage and could be used for early diagnosis of stress fractures.

DTIC

*Biodynamics; Bones; Tibia; Ultrasonics; Fracturing; Stress (Physiology)*

**20030014742** NASA Ames Research Center, Moffett Field, CA USA

**Lipid Biomarkers for Methanogens in Hypersaline Cyanobacterial Mats for Guerrero Negro, Baja California Sur**

Jahnke, Linda L., NASA Ames Research Center, USA; Embaye, Tsegereda, Search for Extraterrestrial Intelligence Inst., USA; Summons, Roger E., Massachusetts Inst. of Tech., USA; Oct. 29, 2002; 2p; In English; NASA Astrobiology Institute General Meeting, 10-12 Feb. 2003, AZ, USA; Sponsored by NASA, USA

Contract(s)/Grant(s): RTOP 344-32-01; Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Distribution as joint owner in the copyright; Distribution as joint owner in the copyright

Analyses of sediments from the vicinity of active methane seeps have uncovered a particular suite of lipid biomarker patterns that characterize methane consuming archaea and their syntrophic, sulfate reducing partners. These isoprenoid biomarkers, largely identified by their anomalously light carbon isotopic signatures, have been a topic of intense research activity and are

recorded in numerous methane-rich environments from Holocene to Cenozoic. This phenomenon has implications for depleted kerogens at 2.7 Ga on early Earth (Hinrichs 2002). In contrast, the lipid biosignatures of methane producing archaea are not readily identified through distinct isotopic labels and have received comparably little attention in analyses of archaea in environmental samples. Indeed, environmental analyses generally detect only free archaeal lipids, not the intact, polar molecules found in the membrane of living organisms. As part of the Ames NAI, the 'Early Microbial Ecosystem Research Group' (EMERG) is working to understand microbial processes in the hypersaline cyanobacterial mats growing in the salt evaporation ponds of the Exportadora de Sal at Guerrero Negro, Baja California Sur, Mexico. The aim of this study was to develop methods by which we could identify the organisms responsible for methane generation in this environment. While the ester-bound fatty acids, hopanoids and wax esters provide a means to identify most of the bacterial components of these mats, the archaea which are evidently present through genomic assays and the fact of intense methane production (Hoehler et al. 2001), have not been identified through their corresponding lipid signatures. Archaeal core lipids present a number of analytical challenges. The core lipids of methanogens comprise C<sub>20</sub>, C<sub>40</sub> and sometimes C<sub>25</sub> isoprenoid chains, linked through ether bonds to glycerol. As well as archaeal (C<sub>20</sub>), sn-2- and sn-3-hydroxyarchaeol are associated particularly with methylotrophic methanogens. Recently, we have also identified a dihydroxyarchaeol in a hyperthermophilic methanogen (Summons et al. 2002). Additional structural diversity is encoded into the polar head groups that are attached to the glycerol ether cores. The C<sub>20</sub> core lipids are readily analyzed by GC-MS as their volatile trimethylsilyl derivatives while compounds with intact polar head groups can only be detected using LC-MS approaches. Our approach was to utilize the alternative of an ether cleavage reagent (BBr<sub>3</sub> vs. HI) and a hydride reducing agent to convert all ether lipids to hydrocarbon in order to provide a vertical profile of quantitative information that might be matched to methane fluxes. We have found that while conventional acid hydrolysis and HI treatment will destroy hydroxyarchaeols, molecular information remains intact through use of BBr<sub>3</sub> for ether cleavage. This method revealed the presence of traces of biphytane and various ether alkyls associated with some sulfate reducing bacteria within the mat structure. An interesting, and potentially valuable, byproduct of the method utilizing HI was the identification of abundant homohopaneoids after superhydride reduction. Evidently present as sulfur-bound diagenetic products these hopaneoids are likely cyanobacterial biomarkers in the early stages of diagenetic preservation.

Author

*Lipids; Biomarkers; Methanation; Bacteria; Sediments; Methane; Carbon; Signatures; Sulfates*

**20030014758** The Geneva Foundation, Tacoma, WA USA

**Effects of Stress Response on Wound Healing *Progress Report***

Clark, S. J.; Oct. 01, 1997; 50p; In English

Report No.(s): PB2003-102391; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The cumulative physiologic effects of psychological, physical and surgical stress result in hypothalamic-pituitary-adrenal (HPA) mediated peripheral vasoconstriction and elevated serum cortisol levels, both of which have been implicated in wound healing. The purpose of this study was to describe the affects of both preoperative and postoperative psychological stress and minor and moderate surgical stress on wound healing in the hope of gaining insight into what characteristics within individuals are most likely to equate with efficient wound healing.

NTIS

*Injuries; Stress (Physiology); Wound Healing; Stress (Psychology); Psychological Effects*

**20030014952** NASA Ames Research Center, Moffett Field, CA USA

**Incorporating Biological Knowledge into Evaluation of Casual Regulatory Hypothesis**

Chrisman, Lonnie, Institute for the Study of Learning and Expertise, USA; Langley, Pat, Institute for the Study of Learning and Expertise, USA; Bay, Stephen, Institute for the Study of Learning and Expertise, USA; Pohorille, Andrew, NASA Ames Research Center, USA; Dec. 10, 2002; 12p; In English; Pacific Symposium in Biocomputing, 2-9 Jan. 2003, Lihue, Maui, USA

Contract(s)/Grant(s): NCC2-1202; NCC2-5471; NCC2-1335; RTOP 344-50-92-02; Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche; Distribution as joint owner in the copyright; Distribution as joint owner in the copyright

Biological data can be scarce and costly to obtain. The small number of samples available typically limits statistical power and makes reliable inference of causal relations extremely difficult. However, we argue that statistical power can be increased substantially by incorporating prior knowledge and data from diverse sources. We present a Bayesian framework that combines information from different sources and we show empirically that this lets one make correct causal inferences with small sample sizes that otherwise would be impossible.

Author

*Statistical Analysis; Functions (Mathematics); Hypotheses; Inference; Bioassay; Mathematical Models; Algorithms*

**20030015255** Pennsylvania Univ., Dept. of Bioengineering, Philadelphia, PA USA

**Engineering Devices to Treat Epilepsy: A Clinical Perspective**

Litt, Brian; Oct. 25, 2001; 6p; In English; Original contains color images; Papers from 23rd Annual International Conference of the IEEE Engineering in Medicine and Biology Society, Oct 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom, The original document contains color images

Report No.(s): AD-A409505; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

25% OF THE WORLD'S 50 MILLION PEOPLE WITH EPILEPSY HAVE SEIZURES THAT CANNOT BE CONTROLLED BY MEDICATION OR EPILEPSY SURGERY. The need for new therapeutic options is clear. Since the 1970's clinicians, neuroscientists and engineers have proposed technologies for treating seizures, with the ultimate goal of implanting stimulators or drug infusion devices in brain to abort seizures before clinical onset. Interest in the field has exploded in recent years, due to evidence suggesting that seizures may be predictable. Device designs range from "blind" stimulators, which do not respond to physiological activity, to "intelligent" devices, which are triggered by detecting or predicting seizure onset. to gain acceptance, intracranial implants will need to demonstrate more than marginal efficacy to justify their invasiveness. Unlike their cardiology predecessors, intelligent implantable epilepsy devices will likely process multiple channels of data, be tuned to individual patients and may need to predict events rather than detect them, for maximal effectiveness. Carefully designed clinical trials will be required to perfect and validate the efficacy of implantable devices for epilepsy, before clinical use becomes widespread.

DTIC

*Activity (Biology); Brain; Data Processing; Drugs; Epilepsy; Predictions*

**20030015257** Alabama Univ., Birmingham, AL USA

**Induction of Human Somatostatin Receptor Subtype 2 on Breast Tumors with an Adenoviral Vector for Their Treatment and Detection with a Radiolabeled Peptide Final Report, 1 Jun. 2001-31 May 2002**

Rogers, Buck E.; Jun. 2002; 16p; In English

Contract(s)/Grant(s): DAMD17-01-1-0470

Report No.(s): AD-A409493; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Targeted radiation therapy for breast cancer is a rational approach, however; there are problems associated with low receptor expression on tumors and bone marrow toxicity due to the long serum half-life of antibodies used to target the radiation. An adenoviral vector encoding the human somatostatin receptor subtype 2 (AdSSTr2) has been produced. The MDA- MB-468 and BT-474 human breast cancer cells were infected with AdSSTr2 and harvested 48 h later for membrane preparations. Membrane SSTr2 expression was determined by a competitive binding assay using iodine-125 (1-125)-labeled somatostatin. Localization of Tc-99m-P2O45 (a high affinity somatostatin analogue) in mice bearing subcutaneous tumors was evaluated by injecting AdSSTr2 i.v. followed by an i.v. injection of Tc-99m-P2O45 48 h later. Localization of Tc-99m-P2O45 was determined by counting tissues in a gamma counter. These studies provide the proof-of-principle that this novel paradigm can be used to treat and detect breast cancer.

DTIC

*Cancer; Mammary Glands; Tumors; Radiation Therapy; Bone Marrow; Clinical Medicine*

**20030015386** Colorado Univ., Health Sciences Center, Aurora, CO USA

**A Biologically-Based Rationale for Combination Chemotherapy of Novel Agents with Doxorubicin in Human Breast Cancer Cell Lines Final Report, 1 Aug. 2001-31 Jul. 2002**

Ross, David; Kroll, David J.; Moran, Julie A.; Baker, Ronda K.; Aug. 2002; 17p; In English

Contract(s)/Grant(s): DAMD17-01-1-0504

Report No.(s): AD-A409401; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

It is common to treat cancer patients with a cocktail of cytotoxic chemotherapeutic agents designed to eradicate cancer cells without overwhelming healthy cells. Unfortunately, patient toxicity often necessitates reduced dosing at the expense of therapeutic success. Recently, researchers have been interested in identifying nontoxic adjunct therapies which could be used to increase the sensitivity of cancer cells to more commonly used chemotherapeutics, allowing reduced prolonged dosing for greater therapeutic success in the absence of patient toxicity. In pursuit of this goal, much attention has fallen on a group of agents called histone deacetylase inhibitors (HDACI). As suggested by their name, these compounds prevent deacetylation of histones resulting in a relaxation of the DNA near the hyperacetylated histones. This opening up of DNA appears to facilitate transcription of the DNA and consequent increased expression of a number of genes 1,2 Increased transcription from the topoisomerase II Ct (topoII) promoter was observed in NIH3T3 cells treated with the HDACI, trichostatin A (TSA) 3. Topoisomerase poisons such as doxorubicin (DOX) are commonly used chemotherapeutics. The sensitivity of cells to these compounds is directly proportional the amount of intracellular topoi protein expression 4. Transcription of the gene encoding death receptor 5 (DR5) appears to

increase in response to the HDACI phenylbutyrate (PB, Kroll unpublished). When bound by its ligand, TNFoc related apoptosis inducing ligand (TRAIL), DR5 initiates a signaling cascade that causes the cell to undergo apoptosis. Although DR5 is widely expressed, TRAIL killing occurs more readily in tumor cells, perhaps due to a lack of expression of the inhibitory decoy receptor, TRID 5,6 HDACIs may, thus, sensitize cells to doxorubicin an&or TRAIL, providing a nontoxic adjunct therapy, which would be expected to work even in advanced breast cancer disease.

DTIC

*Mammary Glands; Cancer*

**20030015387** Tulane Univ., Health Science Center, New Orleans, LA USA

**Involvement of a Human Endogenous Retrovirus in Breast Cancer** *Annual Report, 1 Aug. 2001-31 Jul. 2002*

Garry, Robert F.; Aug. 2002; 9p; In English

Contract(s)/Grant(s): DAMD17-00-1-0472

Report No.(s): AD-A409400; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The genomic DNA of a subset of humans contains an endogenous retrovirus closely related to mouse mammary tumor virus (MWTV). Our overall goal is to determine whether the human mammary tumor virus (HMTV) sequences are involved in a subset of human breast cancers. The first specific aim of this proposal is to recruit and clinically characterize cohorts of breast cancer and appropriate control patients. In studies proposed in the second specific aim, we will identify and sequence HMTV nucleic acids in breast cancer tissue, control tissue, and blood of patients from our cohorts. We will also determine the incidence of HMTV in these various control populations, and compare the sequences of several HMTV genes from different individuals to determine the extent of genetic variability. The third specific aim is to construct DNA or cDNA libraries from tissues positive for HMTV proviruses. In studies under specific aim four, we propose to express HMTV proteins in an insect cell system, which allows stable expression of recombinant proteins, and to characterize the immunological reactions of breast cancer patients and controls against HMTV proteins. If a definitive link is established, HMTV will provide a target for vaccine development and breast cancer therapy.

DTIC

*Mammary Glands; Cancer; Viruses*

**20030015388** British Columbia Univ., Vancouver, British Columbia Canada

**Identification and Characterization of Novel Antimitotic Compounds for the Treatment of Breast Cancer** *Final Report, 15 Jul. 1999-15 Jul 2002*

Roberge, Michel; Aug. 2002; 40p; In English

Contract(s)/Grant(s): DAMD17-99-1-9088

Report No.(s): AD-A409399; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Antimitotics are drugs that kill cancer cells by causing them to arrest in mitosis. Antimitotics currently used in breast cancer therapy include paclitaxel, vincristine and vinbiastine. Although these drugs are extremely valuable, they are not ideal because they have serious side effects, and, most importantly, many breast cancers are resistant to them. Our goal was to find new antimitotic drugs for the treatment of breast cancer using a novel cell-based assay to screen natural product libraries and guide the purification of their active components.

DTIC

*Mammary Glands; Cancer*

**20030015389** Fox Chase Cancer Center, Philadelphia, PA USA

**Dietary Patterns and Prostate Cancer Risk in the NHEFS Cohort** *Annual Report, 1 Jun. 2001-31 May 2002*

Tseng, Marilyn; Jun. 2002; 22p; In English

Contract(s)/Grant(s): DAMD17-01-1-0057

Report No.(s): AD-A409398; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We examined the association between dietary patterns and prostate cancer risk using data from the first National Health and Nutrition Examination Epidemiologic Follow-up Study. The study population included 3,779 men followed 1982-4 to 1992, with 136 prostate cancer cases identified during the follow-up. Principal components analysis on responses to a 105-item diet questionnaire in 1982-84 was used to identify dietary patterns, and scores representing level of intake of each pattern were categorized into textiles. Three distinct patterns were identified: a vegetable-fruit pattern, a red meat-starch pattern characterized by intake of beef, pork, potatoes, and sweets, and a southern pattern characterized by foods including cornbread, grits, bacon, beans, and okra. In proportional hazards models, prostate cancer risk was not associated with the red meat-starch pattern, but it was non-significantly higher with intermediate consumption of a fruit-vegetable pattern and non-significantly lower with high intake of a southern dietary pattern (RR=0.6, 95% CI 0.4-1.1 for highest vs. lowest textile). of the nutrients and foods that we

examined, only calcium and dairy foods were associated with prostate cancer risk, but RR estimates for dietary patterns were unchanged after adjustment for either calcium or dairy. Features of the patterns that might contribute to the associations that we observed have yet to be elucidated.

DTIC

*Nutrition; Cancer*

**20030015390** California Univ., Lawrence Berkeley Lab., Berkeley, CA USA

**Oxidative Damage, CYP1B1 and Breast Cancer Final Report, 1 Jul. 2001-30 Jun. 2002**

Goth-Goldstein, Regine; Jul. 2002; 19p; In English; Original contains color images

Contract(s)/Grant(s): DAMD17-01-1-0543

Report No.(s): AD-A409396; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Oxidative damage to DNA has been shown to occur in vivo indicating that DNA can be damaged as a consequence of normal metabolism. Because a large number of DNA base modifications are caused by oxidative stress, it is difficult to measure the whole spectrum of modified lesions. One of the more abundant lesions, 8-hydroxy- 2'-deoxyguanosine (8-oxoG), which is known to cause a G to T transversion, is used as a reliable index of overall oxidative DNA damage. DNA bases modified by oxidative stress can lead to mutations, chromosomal abnormalities and altered gene expression.

DTIC

*Mammary Glands; Cancer*

**20030015391** Pennsylvania State Univ., University Park, PA USA

**Design, Synthesis, and Evaluation of Estrogen Sulfotransferase Inhibitors: Potential Enhancers of Tamoxifen-Mediated Apoptosis in ER Negative Breast Cancers Final Report, 1 Jul. 2002-30 Jun. 2002**

Peterson, Blake R.; Jul. 2002; 6p; In English

Contract(s)/Grant(s): DAMD17-01-1-0594

Report No.(s): AD-A409395; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Small molecule - protein interactions underlie many fundamental processes in biology and provide a basis for pharmacological intervention in human disease. Given that most proteins are only marginally stable, molecular recognition between small molecules and enzyme active sites or protein ligand binding domains (LBDs) often stabilizes protein folding. Ligand-mediated protein stabilization has been recently employed in yeast assays to couple cellular growth to ligand binding of proteins fused to the essential metabolic enzyme dihydrofolate reductase. The autocatalytic green fluorescent protein (GFP) from *Aequorea victoria* has also been utilized as a folding reporter that confers a fluorescent signal proportional to the extent of folding of fused proteins. Proteins have also been inserted into loops on the surface of GFP to construct biosensors. Most cellular biosensors of small molecules are based on relatively complex two-hybrid systems, in which ligand binding is used to trigger protein dimerization to activate expression of a reporter gene. However, ideal biosensors would be homogenous (reagentless) and provide a reporter function intrinsic to the sensor molecule without requiring covalent modification or assembly of macromolecular components.

DTIC

*Estrogens; Mammary Glands; Cancer*

**20030015393** Northwestern Univ., Evanston, IL USA

**An Experimental Model for Lymphangiogenesis and Lymphatic Metastasis Final Report, 1 Jul. 2001-30 Jun. 2002**

Swartz, Melody A.; Jul. 2002; 7p; In English

Contract(s)/Grant(s): DAMD17-01-1-0584

Report No.(s): AD-A409393; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

For patients diagnosed with cancer, metastasis is the most critical prognostic factor. Even after surgical removal and systemic chemo- or radiotherapy of the primary tumor, it is often the metastases that cause morbidity. One avenue of tumor cell metastasis is the circulation, but some of the most common cancers metastasize through the lymphatic system, as evidenced by the location of the metastases in local and/or regional lymph nodes or as in-transit metastases. Nonetheless, our understanding of lymphatic metastasis lags far behind that of the hematogenous route. One major block in illuminating the mechanisms of lymphatic metastasis is the lack of a cohesive understanding of lymphatic biology, function, and neogenesis. It is still unclear how tumors gain access to the lymphatics; they may alter peripheral lymphatic vessels, induce peripheral lymphangiogenesis, or simply invade preexisting lymphatics. The lack of a cohesive understanding of lymphatic biology is the major hurdle in studying lymphatic

metastasis. Systematic studies can only be realized with the development of model systems of normal and tumor lymphangiogenesis.

DTIC

*Cancer; Metastasis; Lymphatic System*

**20030015395** California Univ., Lawrence Berkeley Lab., Berkeley, CA USA

**Characterization of Chemopreventive and Chemotherapeutical Activities and Compound(s) from an Amazonian Plant Final Report, 4 Sep. 2001-3 Sep 2002**

Lupu, Ruth; Oct. 2002; 12p; In English

Contract(s)/Grant(s): DAMD17-01-1-0544

Report No.(s): AD-A409390; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Worldwide, cancer accounts for more than 6 million deaths annually. According to estimates from the American Cancer Society, approximately 1.2 million new cancer cases were to be diagnosed in 1998 in the USA, including 178,700 diagnoses of breast cancer in women. Polypeptide growth factors play important roles in both normal and pathological development of the breast. Such growth factors promote cell proliferation, motility and invasiveness of epithelial cells in vitro, properties that are required for tumor invasiveness and metastasis. Recent experimental evidence suggests that estrogens stimulate breast proliferation in hormone-dependent cells by upregulation of an autocrine stimulatory loop involving epidermal growth factor receptor related tyrosine kinases (erbB-2). The erbB-2 oncogene product has been shown to be expressed in approximately 25-30% of breast cancer patients, and has been correlated with poor prognosis and unfavorable survival rate (5,6). Frequently, patients whose tumors express erbB-2 receptors do not respond well to conventional therapies, emphasizing the need for more aggressive therapies. Although the exact role of erbB-2 in tumor development has yet to be elucidated, tyrosine kinase-mediated signal transduction appears to play an important role in breast cancer progression and metastasis.

DTIC

*Chemotherapy; Drugs; Cancer; Mammary Glands*

**20030015412** Nevada Univ., Las Vegas, NV USA

**Cell Migration as a Therapeutic Target in Malignant Breast Cancer Annual Report, 1 Sep. 1998-31 Aug. 2002**

Plopper, George E., Jr.; Sep. 2002; 141p; In English; Original contains color images

Contract(s)/Grant(s): DAMD17-98-1-8325

Report No.(s): AD-A409486; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

The objects of this project are to develop a high-throughput method for screening potential inhibitors of breast cancer cell migration, and to apply this method to identify signaling events mediating constitutive migration of malignant breast cells. The pathways that control these signaling events may be targets for development of new classes of anti-tumor drugs. The significant advances made during this project include (1) development of an efficient, high-throughput migration assay compatible with drug screening; (2) identification of three molecules that are involved in integrin-mediated cell signaling and migration (RACK 1, Focal Adhesion Kinase, and Ca<sup>2+</sup>); (3) development of a model system for examining integrin-specific signaling in breast cells adhering to laminin-1; and (4) the identification of perillyl alcohol as a non-cytotoxic inhibitor of breast cell migration. The significance of this work is demonstration of the utility of the novel migration inhibitor drug screen we have developed, plus development of reagents that will enable us to examine the signaling associated with specific integrin complexes in breast cells.

DTIC

*Mammary Glands; Cancer; Migration; Therapy; Cells (Biology)*

**20030015413** Columbia Univ., New York, NY USA

**Characterization of a Novel Tumor Suppressor Gene, mda-7, and its Ability to Induce Apoptosis Annual Report, 1 Aug. 1998-31 Jul. 2002**

Sarkar, Devanand; Fisher, Paul B.; Aug. 2002; 18p; In English

Contract(s)/Grant(s): DAMD17-98-1-8053

Report No.(s): AD-A409484; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Subtraction hybridization identified melanoma differentiation associated gene-7 (mda-7) as a gene induced during terminal differentiation in human melanoma cells. Administration of mda-7 by means of a replication-incompetent adenovirus (Ad.mda-7) induces apoptosis selectively in diverse human cancer cells without inducing harmful effects in normal fibroblast or epithelial cells. The present studies investigated the mechanism underlying this differential apoptotic effect. Infection with Ad.mda-7 induced a family of growth arrest and DNA damage (GADD)-inducible genes in diverse cancer cell lines but not in their normal counterparts, which correlated with induction of apoptosis. Treatment with SB203580, a selective inhibitor of p38 MAPK, and

infection with an adenovirus expressing a dominant negative inhibitor of p38 MAPK, effectively inhibited Ad.mda-7-induced apoptosis and GADD gene family induction. Ad.mda-7 infection resulted in phosphorylation of p38 MAPK in cancer cells but not in normal cells. Inhibition of GADD genes by an antisense approach effectively blocked Ad.mda-7-induced apoptosis. These results support the hypothesis that Ad.mda-7 mediates induction of the GADD family of genes by means of the p38 MAPK pathway, thereby resulting in the selective induction of apoptosis in cancer cells.

DTIC

*Genes; Apoptosis; Cancer; Mammary Glands; Tumors; Suppressors*

**20030015414** University of South Florida, Tampa, FL USA

**The CAD Method for Microcalcification Detection: Independent of Sensor and Resolution** *Annual Report, 1 Jul. 2001-30 Jun. 2002*

Qian, Wei; Jul. 2002; 18p; In English

Contract(s)/Grant(s): DAMD17-99-1-9374

Report No.(s): AD-A409482; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The aims of this work are to explore the feasibility of developing a new class of computer assisted diagnostic (CAD) methods for microcalcification cluster (MCC) detection for breast cancer screening using digital mammography. The objectives are to achieve: (a) improved CAD performance that is significantly more robust for large image databases, and (b) an adaptive CAD method that is independent of the digital sensor resolution and gray scale characteristics; for the first time. This report includes 3 sections: (1). Summary of the work in first year, which includes data base collection and truth file establishment for different sensors, preprocessing for breast area segmentation, and basic algorithm design and optimization, (2) Summary of the work in second year, which includes algorithm design and modular optimization for enhancement, segmentation, feature extraction and classification. (3). Whole system optimization and evaluation, which includes a design, optimization and evaluation of a successful MCCs detection system.

DTIC

*Calcium; Detection; Cancer; Mammary Glands; Computer Aided Tomography; Computer Techniques*

**20030015415** Sloan-Kettering Inst. for Cancer Research, New York, NY USA

**Synthesis of Epothilone Analogs: Toward the Development of Potent Anticancer Drugs** *Annual Report, 1 Jan. 1999-31 Jul. 2002*

Biswas, Kaustav; Danishefsky, Samuel J.; Aug. 2002; 67p; In English; Original contains color images

Contract(s)/Grant(s): DAMD17-98-1-8155

Report No.(s): AD-A409475; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Epothilones are cytotoxic natural products that inhibit the growth of cancer cells by the same tubulin-stabilizing mechanism of Taxol. We have been developing a program in epothilone-based chemotherapy, and have succeeded in accomplishing efficient synthetic protocols to access large amounts of important analogs quickly. Our lead candidate, 12,13-desoxyepothilone B (dEpoB), is currently in Phase I clinical trials. To further develop and screen a variety of strong back-up candidates in our clinical development program, we have made and tested a series of dehydro-desoxy-epothilones. In the process, we have also discovered an even more practical synthetic process toward the synthesis of our lead drug candidate, dEpoB. We have also examined the scope of synthetic modifications to the natural epothilone structure with regards to biological activity. These experiments include the expansion of the ring-size of the epothilones and introduction of trifluoromethyl groups. These studies demonstrate that the dehydroepothilones are viable cytotoxic agents, and that minimal ring-expansion strategies maintain the biological activity of the epothilones.

DTIC

*Cancer; Drugs; Synthesis (Chemistry); Chemotherapy*

**20030015416** Toronto Univ., Ontario Canada

**The Effects of Folate on the Development of Breast Cancer in a Chemical Rodent Model of Mammary Carcinogenesis** *Annual Report, 1 Aug. 2001-31 Jul. 2002*

Young-in, Kim; Aug. 2002; 61p; In English

Contract(s)/Grant(s): DAMD17-01-1-0428

Report No.(s): AD-A409473; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Epidemiological studies suggest that dietary folate intake and blood levels of folate are inversely related to breast cancer risk. Because only few modifiable risk factors for breast cancer exist, the role of folate in modifying breast cancer risk merits further consideration. Folate is an ideal agent for chemo-prevention of breast cancer. It is a natural vitamin, inexpensive, virtually free

of side effects, and possesses biologically plausible mechanisms for cancer prevention. However, folate appears to possess dual modulatory effects on carcinogenesis depending on the timing and dose of folate intervention. Folate deficiency has an inhibitory, whereas folate supplementation has a promoting, effect on progression of established neoplasms. By contrast, folate deficiency in normal tissues predisposes them to neoplastic transformation, and modest levels of folate supplementation suppress, whereas supraphysiologic doses enhance, the development of tumors in normal tissues. Therefore, the potential effect of folate chemoprevention needs to be clearly established in appropriate animal models before folate supplementation can be considered in humans. Given these considerations, this proposal investigates the effects of dietary folate deficiency and supplementation on mammary tumorigenesis and potential molecular and cellular mechanisms by which folate modulates mammary tumorigenesis in the well established carcinogen rat model of breast cancer.

DTIC

*Chemotherapy; Folic Acid; Cancer; Mammary Glands; Tumors; Prevention*

**20030015417** Howard Univ., Washington, DC USA

**A Training Program in Breast Cancer Research Using NMR Techniques** *Annual Report, 1 Jul. 2001-30 Jun. 2002*

Wang, Paul C.; Jul. 2002; 17p; In English; Original contains color images

Contract(s)/Grant(s): DAMD17-00-1-0291

Report No.(s): AD-A409467; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

In the second year, this program has supported two graduate students (one from the Electrical Engineering Department and one from the Biochemistry Department) and three postdoctoral fellows (Radiology Department). This program supports the graduate students in the second year. The new postdoctoral fellows have been introduced to the Biomedical NMR Laboratory and the Howard University Cancer Center. The trainees have continued to learn the theory and instrumentation of nuclear magnetic resonance imaging and spectroscopy. The trainees have rotated through the mammography service in the Department of Radiology in the hospital to learn the mammography procedures. Besides attending the weekly seminars in the Cancer Center, the trainees also have attended a special seminar series on the breast imaging sponsored by this grant and the Department of Electrical Engineering. The trainees have actively participated in several research projects. Based on the experimental findings, one paper was published and three posters have been presented in the national scientific meetings. Two graduate student trainees have passed their comprehensive exams and have started research for their Ph.D. thesis. One postdoctoral trainee has completed his radiology resident training. The PI has submitted a NIH grant as a co-investigator.

DTIC

*Nuclear Magnetic Resonance; Education; Cancer; Mammary Glands*

**20030015420** Minnesota Univ., Minneapolis, MN USA

**Insulin-Like Growth Factor Binding Protein-1 Interacts With Integrins to Inhibit Insulin-Like Growth Factor-Induced Breast Cancer** *Annual Report, 1 Jul. 2001-30 Jun. 2002*

Gross, Jennifer M.; Yee, Doug; Jul. 2002; 8p; In English

Contract(s)/Grant(s): DAMD17-01-1-0329

Report No.(s): AD-A409450; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The insulin-like growth (IGF) system and extracellular matrix proteins are key regulators of the malignant breast cancer phenotype. Both IGFs and extracellular matrix proteins communicate with epithelial cells by ligating cell surface receptors. Therefore ligand-receptor interactions of the two systems are relevant treatment targets in breast cancer. Studies have shown that IGFBP-1 can bind to IGF and prevent GE from interacting with its receptor and inhibit breast cancer cell growth. IGFBP-1 has also been shown to interact with extracellular matrix protein receptors, integrins, on the cell surface through an Arg-Gly-Asp (RGD) integrin recognition sequence. This work-in-progress will test the hypothesis that IGFBP-I interrupts ligand-receptor interactions between extracellular matrix proteins and integrins. The key research accomplishment is the cloning and expression of a mutant IGFBP-1 protein species that will not interact with integrins. The successful expression and purification of the mutant IGFBP-1 protein is needed to test whether IGFBP-1 can be used as a strategy to neutralize integrin function in an RGD-dependent mechanism. The long-term goal is to provide evidence that IGFBP-1 is a novel therapy for the treatment of breast cancer.

DTIC

*Cancer; Insulin; Mammary Glands; Proteins; Gene Expression; Receptors (Physiology)*

**20030015426** Massachusetts Univ., Medical School, Worcester, MA USA

**99m Tc-Peptides for Detection of Breast Cancer Final Report, 1 Aug. 1999-31 Jul. 2002**

Rusckowski, Mary; Aug. 2002; 27p; In English

Contract(s)/Grant(s): DAMD17-99-1-9280

Report No.(s): AD-A409438; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The goal of this project was to identify peptides from phage display peptide libraries which bind with high affinity to the mutant EGFRvIII receptor present in breast tumors. The peptides selected were radiolabeled with technetium-99m (99mTc) and tested for their potential as agents in the detection of breast cancer. Using available phage display peptide libraries, we have identified five consensus peptides that show affinity for cells expressing the mutant EGFRvIII receptor. Characterization of these selected peptides was by ELISA and radiolabeled cell binding studies. First, the labeled phage were tested in in vitro assays and in mice with tumors. Specific binding of The labeled phage to the study cells was found relative to the control cells. Also, mice with tumors expressing the mutant receptor showed enhanced accumulation of the labeled phage over mice with tumors expressing the wild-type receptor. The consensus peptides were identified through analysis of the phage DNA. The peptides were synthesized, then conjugated to a chelator for radiolabeling with 99mTc. All peptides have been tested in in vitro assays and tested in tumor bearing mice. The in vivo studies show that the 99mTc peptide clear the circulation quickly and demonstrate accumulation in breast tumor. Peptides have also been evaluated against a panel of tumor from clinical pathology. Early results suggest a distinction of peptides for various tumors.

DTIC

*Cancer; Mammary Glands; Pathology; Peptides; Technetium*

**20030015430** California Univ., Lawrence Berkeley Lab., Berkeley, CA USA

**PIAS1 and PIAS3 Protein Interaction with HsRad51 and HeRad52 May Downregulate Recombination Repair in Human Mammary Epithelial Cells Final Report, 1 Aug. 2001-31 Jul. 2002**

Schild, David; Aug. 2002; 8p; In English; Original contains color images

Contract(s)/Grant(s): DAMD17-01-1-0545

Report No.(s): AD-A409424; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Characterization of BRCA1 and BRCA2 has strongly implicated homologous recombinational repair (HRR) as a pathway important in breast cancer. Rad51 and Rad52 are two additional proteins important for HRR, and we are characterizing some proteins that interact with them. Using the yeast two-hybrid system, we had shown that the human proteins PIAS1 and PIAS3 (protein inhibitors of activated STATs) specifically interact with Rad51 and Rad52. Recently, PIAS1 has been shown by others to interact with p53 and to be involved in its sumoylation. Sumoylation is related to ubiquitination, but does not appear to tag a protein for degradation. During the last year we confirmed the interaction between PIAS1 and hRad51 using purified hRad51 and PIAS1-GST fusion proteins. In addition, the regions of PIAS1 that interact with Rad51, Rad52 and P53 were mapped and shown to completely overlap. This region is the acidic domain of PIAS1 (PIAS1-AD).

DTIC

*Mammary Glands; Cancer; Proteins*

**20030015431** Manitoba Univ., Winnipeg, Manitoba Canada

**Resources for Precision Analysis of Human Breast Cancer Final Report, 15 Jul. 1999-15 Jul 2002**

Watson, Peter H.; Aug. 2002; 268p; In English

Contract(s)/Grant(s): DAAD17-99-1-9272

Report No.(s): AD-A409423; No Copyright; Avail: CASI; A12, Hardcopy; A03, Microfiche

The past decade has seen dramatic progress in our understanding of the basic cell and molecular biology of breast cancer. However, the translation of this basic science knowledge and ideas has been impeded by the limited numbers of clinician-scientists with skills to effectively collaborate with basic scientists and to accurately interpret tissue pathology, quality and the cellular composition of heterogeneous tissue samples subjected to molecular study. Beyond this there is the problem of access to appropriate human tissue samples. The Pi's overall goal is the improvement in our current ability to predict individual risk of development of invasive disease and to predict further progression of invasive disease in terms of resistance to therapies. The specific aims of the PI are (1) continue to advance the two general avenues of research that are currently ongoing in the laboratory and which have direct relevance to important clinical problems in the management of early pre-invasive disease and the therapy of later advanced disease, (2) continue to direct the Manitoba Breast Tumor Bank and offer clinical pathology expertise and advice to many investigators who seek access to appropriate tissues to test their ideas, and (3) to work with others to develop and analyze

new tissue resources such as those based on collection of pre-invasive lesions and tissue samples and collection of tumor samples associated with clinical trials.

DTIC

*Awards; Mammary Glands; Cancer*

**20030015433** Pennsylvania Univ., Medical Image Processing Group, Philadelphia, PA USA

**The Role of Breast Cancer Derived Prostaglandin E2 in the Elaboration of a Therapeutic Immune Response *Final Report, 1 Jul. 1998-30 Jun. 2001***

Eck, Stephen L.; Jul. 2001; 19p; In English

Contract(s)/Grant(s): DAMD17-98-1-8328

Report No.(s): AD-A409420; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The principal goal was to understand why breast cancer cells are able to evade the host immune system despite the presence of tumor antigens and tumor antigen-specific T lymphocytes. We had previously demonstrated that tumor-derived prostaglandin E2 (PGE2) directly contributes to the lack of a significant immune response to breast cancer cells. However, the production of PGE2 by breast cancer cells did not completely explain the immune suppressive effect of breast cancer cells. We have subsequently demonstrated that GA733-2/ MEGP, a type I cell surface breast cancer protein, is able to efficiently block the presentation of a variety of antigens from dendritic cells (DC).

DTIC

*Mammary Glands; Cancer*

**20030015435** Virginia Commonwealth Univ., Richmond, VA USA

**Radiosensitization of Human Mammary Carcinoma Cells by Specific Inhibition of Signal Transduction Cascades *Annual Report, 1 Aug. 2001-31 Jul. 2002***

Dent, Paul; Aug. 2002; 61p; In English

Contract(s)/Grant(s): DAMD17-99-1-9426

Report No.(s): AD-A409418; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

We investigated the impact of combined exposure to the check-point abrogator (UCN-01) in conjunction with MEK1/2 inhibitors upon survival of mammary carcinoma cells. Treatment of cells with UCN-01 resulted in prolonged activation of the MAPK pathway. Inhibition of MEK1/2 caused modest reductions in basal MAPK activity and suppressed UCN-01-stimulated MAPK activity below that of MEK1/2 inhibitor alone. Significantly, combined, but not individual, exposure of cells to UCN-01 and MEK1/2 inhibitors enhanced BAX association with mitochondria and triggered release of cytochrome c into the cytosol, accompanied by activation of effector pro-caspases, resulting in a synergistic potentiation of apoptosis within 18-24th. Radiation exposure of drug treated cells did not further enhance apoptosis. Treatment of cells with both caspase 9 and caspase 8 inhibitors was required to completely inhibit apoptosis in carcinoma cells.

DTIC

*Mammary Glands; Cancer*

**20030015437** Georgetown Univ., Medical Center, Washington, DC USA

**A New APC-Like Gene Involved in Regulation of Beta-Catenin/LEF Signaling *Annual Report, 1 Jul. 2001-30 Jun. 2002***

Jarrett, Christy R.; Jul. 2002; 17p; In English; Original contains color images

Contract(s)/Grant(s): DAMD17-99-1-9197

Report No.(s): AD-A409414; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A second adenomatous polyposis coli (APC)-like gene, APC2/APCL was recently described and localized to chromosome 19. We have fine mapped APC2 to a small region of chromosome 19p13.3 containing markers DI 95883 and WI-19632, a region commonly lost in a variety of cancers, particularly ovarian and breast cancer. Interphase FISH analysis revealed an APC2 allelic imbalance in 19 of 20 ovarian and 4/20 breast cancers screened and indicates that APC2 could be a potential tumor suppressor gene in breast and ovarian cancer. When over-expressed in cells that express low levels of APC2, exogenous APC2 localized to the Golgi apparatus, actin-containing structures, and occasionally to microtubules. Antibodies against the N-terminus of human APC2 show that endogenous APC2 is diffusely distributed in the cytoplasm and co-localizes with both the Golgi apparatus and actin filaments. APC2 remained associated with actin filaments following treatment with the actin-disrupting agent, cytochalasin D.

DTIC

*Mammary Glands; Cancer*

**20030015438** Queens Univ., Kingston, Ontario Canada

**Identification of Hepatocyte Growth Factor Autocrine Loops in Breast Carcinomas: Possible Target for Therapeutic Intervention** *Annual Report, 1 Jul. 2001-1 Jul 2002*

Wright, Theodore G.; Elliot, Bruce E.; Aug. 2002; 21p; In English

Contract(s)/Grant(s): DAMD17-99-1-9360

Report No.(s): AD-A409412; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Hepatocyte growth factor (HGF) binding to its transmembrane receptor, Met, results in an increase in breast epithelial cell motility, morphogenesis and metastasis. HGF-like forms have been detected as secretion products of the human breast epithelial carcinoma cell line, MCF10A1T3B. The two major products are <sup>^</sup>56 and <sup>^</sup>32 kDa. Recombinant HGF treatment with elastase produced the <sup>^</sup>56 kDa HGF antagonistic product, an NK4-like form. Anion exchange chromatography of conditioned medium indicated that MCF10A1T3B secretion products have decreased affinity compared to endogenous full-length HGF.

DTIC

*Proteins; Cancer; Mammary Glands*

**20030015439** Pittsburgh Univ., Pittsburgh, PA USA

**Novel Thioredoxin Inhibitors for Breast Cancer Therapy** *Annual Report, 1 Jul. 2001-30 Jun. 2002*

Lazo, John S.; Jul. 2002; 12p; In English

Contract(s)/Grant(s): DAMD17-00-1-0412

Report No.(s): AD-A409411; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The hypothesis being tested is that the thioredoxin redox signaling system is essential for the growth of some human breast cancers and that drugs inhibiting this system will block oncogenesis and cause selective growth inhibition and/or apoptosis. The specific objectives of the IDEA proposal are to generate and identify selective inhibitors of thioredoxin using target-array chemistry methodologies, in vitro assays and cell-based screening approaches. The scope of the research activity demanded that we develop semi-automated synthetic methodology. We ultimately intend to select one or more lead compounds that could be optimized as candidates for clinical development, which would encompass a Clinical Translational Research (CTR) proposal. We will perform preclinical pharmacokinetics and formulation studies on any interesting candidates.

DTIC

*Chemotherapy; Mammary Glands; Cancer; Drugs*

**20030015441** Michigan Univ., Ann Arbor, MI USA

**Automated Method for Analysis of Mammographic Breast Density - A Technique for Breast Cancer Risk Estimation** *Annual Report, 1 Jul. 2001-30 Jun. 2002*

Chang, Heang P.; Jul. 2002; 32p; In English; Original contains color images

Contract(s)/Grant(s): DAMD17-01-1-0326

Report No.(s): AD-A409409; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Previous studies have found that there is a strong correlation between mammographic breast density and the risk of breast cancer. Mammographic breast density has been used by researchers in many studies to estimate breast cancer risk of epidemiological factors, monitor the effects of preventive treatments such as tamoxifen or dietary interventions, monitor the breast cancer risk of hormone replacement therapy, and investigate factors affecting mammographic sensitivity and cancer prognosis. However, most studies used Breast Imaging Reporting and Data System (BI-RADS) density rating as a measure of mammographic breast density, which contributes large inter- and intraobserver variations and may reduce the sensitivity of the analysis.

DTIC

*Mammary Glands; Cancer; Imaging Techniques*

**20030015442** Dartmouth Coll., Hanover, NH USA

**Targeting a Novel Vector for Breast Cancer Gene Therapy** *Final Report, 15 Jul. 1999-14 Jul 2002*

Bzik, David J.; Aug. 2002; 18p; In English

Contract(s)/Grant(s): DAMD17-99-1-9167

Report No.(s): AD-A409408; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We are testing the hypothesis that a model parasite gene therapy vector can be genetically altered to safely, specifically and effectively target breast cancer cells in vitro and in vivo. The primary purpose and scope of this IDEA award project is to experimentally examine approaches to safely target the Toxoplasma gondii parasite gene therapy vector to breast cancer tissue using in vitro and in vivo models. We found that cytosine deaminase (CD) and thymidine kinase (TK) markers expressed in T

gondii produce a significant bystander killing effect on both human fibroblasts and SKBR3 tumor cells in vitro. We report the construction of a highly attenuated uracil auxotrophic T gondii parasite strain for safely targeting gene therapy to breast cancer. Using trifunctional enzyme expression plasmids we co-expressed TK and CD markers in transgenic T gondii. An approach for selectively targeting the TK and CD transgenes to HEK2/neu overexpressing cells was examined. We found that a bi-specific antibody with specificity to Mer2/neu and a major T gondii surface antigen provided a small but detectable increase in the fraction of Her2/neu cells infected by the targeting parasite, and sensitization of tumors cells to killing by ganciclovir or 5-fluorocytosine therapy. Improved technology will need to be developed to improve the specificity of the targeting strategy in this model.

DTIC

*Mammary Glands; Cancer; Gene Therapy; Enzymes*

**20030015445** King Saud Univ., Riyadh Saudi Arabia

**Development of a New Program in Biomedical Instrumentation Technology in Technology Colleges in Kingdom of Saudi Arabia**

Al-Mejrad, Ali S.; Oct. 25, 2001; 3p; In English

Report No.(s): AD-A409405; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

During the recent years the country has witnessed a proliferation of clinics, medical centers and hospitals all equipped with up to date high technology medical instrumentation. This in turn needs qualified personnel capable of installing, operating and maintaining these medical instruments. To qualify such qualified technicians, a program of biomedical instrumentation technology is needed to be found. In this paper the new proposed program of biomedical instrumentation technology in technology colleges will be presented.

DTIC

*Medical Equipment; Biological Effects*

**20030015446** Cincinnati Univ., OH USA

**Control of Carcinoma Cell Motility by E-Cadherin Final Report, 1 Aug. 1998-31 Jul. 2002**

Brackenbury, Robert W.; Aug. 2002; 29p; In English; Original contains color images

Contract(s)/Grant(s): DAMD17-98-1-8292

Report No.(s): AD-A409404; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Tumor invasion is a major obstacle to effective clinical management of breast cancer. To identify new targets for anti-invasive therapies, we have focused on the mechanisms by which the cell adhesion molecule E-cadherin suppresses tumor invasion. A related cadherin, N-cadherin, does not suppress cell movement, even though it is as effective as E-cadherin at mediating adhesion. We analyzed deletion mutants and exploited the difference between E- and N-cadherin to define regions of E-cadherin required for suppression of movement. We localized the key region that differs between E-cadherin and N-cadherin to a region consisting of the transmembrane segment and a small portion of the cytoplasmic domain, but demonstrated that E-cadherin does not regulate motility through sequestering p120, at physiological levels of expression. We also found that the catenin-binding domain is also required. Further, we identified two components that are tyrosine phosphorylated after E-cadherin contact, but determined they play no role in suppression of motility. We developed a new assay for analyzing the effect of cadherins on cell movement, which revealed that E-cadherin, but not N-cadherin, suppresses movement in intact monolayers of cells.

DTIC

*Clinical Medicine; Mammary Glands; Cancer*

**20030015448** Kimmel (Sidney) Cancer Center, San Diego, CA USA

**Selective Retinoids That Inhibit IKK as Chemotherapeutic Agents Against Estrogen-Independent Breast Cancer Cells Annual Report, 16 Jul. 2002-15 Jul 2002**

Piedraftia, Francisco J.; Aug. 2002; 10p; In English

Contract(s)/Grant(s): DAMD17-01-1-0625

Report No.(s): AD-A409402; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

We have investigated the effect of novel selective retinoid-related molecules that induce apoptosis in breast cancer cells on IKK/NF kappa B activity. We identified one retinoid antagonist that elicited a strong inhibition of IKK in the ER-negative cell line MDA-MB-468. Other retinoid analogs were not as potent IKK inhibitors in intact cells, although they exerted a significant inhibition of IKK in vitro and a strong inhibition of cell proliferation that correlated with the induction of apoptosis in ER-negative cells. Our data observed in breast cancer cells as well as in cells obtained from other type of human tumors indicate that the inhibition of IKK/NF kappa B activity is critical for the induction of apoptosis by the retinoid antagonist, but not by other retinoid analogs. Our findings with non-retinoid analogs known to inhibit IKK and a non-pharmacological approach to block IKK/NF

kappa B signaling, indicate that inhibition of this pathway is sufficient to induce cell death. Therefore, inhibitors of IKK could serve as promising new anticancer agents, either as a stand-alone therapy or in combination therapies with other anticancer approaches. In this respect, it is noteworthy that inhibitors of IKK sensitize tumor cells to the anticancer activity of certain chemotherapeutic drugs.

DTIC

*Mammary Glands; Cancer; Retinene*

**20030015763** Tulane Univ., Health Science Center, New Orleans, LA USA

**Development of an EBV-Mammary Epithelial Cell Model for Addressing the Role of EBV in Breast Cancer** *Annual Report, 1 Aug. 2001-31 Jul. 2002*

Flemington, Erik K.; Aug. 2002; 6p; In English

Contract(s)/Grant(s): DAMD17-01-1-0511

Report No.(s): AD-A409341; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

In this grant we proposed to generate an EBV infected mammary epithelial system that could be used to characterize the life cycle and oncogenic properties of EBV in this unique tissue. We have been utilizing primary human mammary epithelial cell lines generated in Myles Brown's laboratory. By Fluorescence Activated Cell Sorting (FACS), we determined that these cells are positive for the EBV receptor, CR2 and we have been carrying out infection studies to determine the infectability of these cells to SBV. to date we have found that despite the presence of the CR2 receptor, infectability is relatively low. This makes transient studies more difficult. We have therefore, begun generating long term cultures of infected IMEC cells through a variety of different means. We believe that we are making encouraging progress but we estimate that the completion of this project will require another year to complete. We have therefore obtained a 1 yr no cost extension to allow us to complete this work.

DTIC

*Cancer; Infectious Diseases; Carcinogens*

**20030015767** Academy of Health Sciences (Army), Health Care Administration, Fort Sam Houston, TX USA

**Make VS. Buy: An Analysis of the Victory Clinic and the Primary Care Empanelment Model at Martin Army Community Hospital**

Boham, Robert S.; Jul. 21, 2000; 54p; In English; Original contains color images

Report No.(s): AD-A409345; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Changes in policy and rising healthcare costs have forced the Military Health System (MHS) to operate as a business similar to civilian healthcare organization. Providing the best possible healthcare for less is critical to the success of the organization. Primary Care and the Primary Care Manager (PCM) are an essential part of maintaining beneficiary health status and keeping the costs of healthcare at a minimum. Martin Army Community Hospital (MACH) has two Family Practice Clinics, which produce the majority of the primary care workload in the facility. The MACH Family Practice Clinic and the Victory Clinic, a General Services Contracted Clinic, are two portals to the primary care manager in the family practice arena. A make Vs buy analysis was conducted to determine the most cost-effective method of providing Primary Care to the beneficiary population. The Family Practice Clinic at MACH was compared to civilian industry benchmarks of panel size, productivity, support staff, and exam room availability to improve the efficiency of the clinic. This study suggests that MACH can improve the efficiency of the Family Practice Clinic by using the industry benchmarks and reduce the overall costs of healthcare to the facility by terminating the General Services Contract and converting the Victory Clinic to an "in-house" clinic.

DTIC

*Workloads (Psychophysiology); Clinical Medicine; Health*

**20030015768** Academy of Health Sciences (Army), Health Care Administration, Fort Sam Houston, TX USA

**Delivering the TRICARE Promise at Fort Carson**

Garrity, John; Apr. 14, 2000; 49p; In English

Report No.(s): AD-A409346; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Delivering the TRICARE Promise involves compliance with specific standards especially in the area of access. The TRICARE pamphlets that are given to beneficiaries state that they should get an acute appointment within 24 hours and for routine care an appointment within one week. Prevention/wellness appointments are scheduled within a month. Patients should have to wait no longer than 30 minutes to see a provider during an appointment. The pamphlets also state that the beneficiary gets to choose their own individual primary care manager. At Fort Carson a conscious decision was made to enroll to teams or clinics not individual primary care managers based on medical need. Active duty patients on sick call are exempt from the standard of waiting no longer than 30 minutes to see a provider. The Surgeon General's directive in July of 1999 for all beneficiaries to be assigned

to an individual primary care manager was an opportunity to review the implementation of the TRICARE Promise at Fort Carson. This project evaluates the "Promise" beginning with inprocessing to the post through assignment of a primary care manager to what actions are taken when a beneficiary who is an active duty soldier, a family member, or a retiree requires medical care. This project led to a revision of the Welcome Center TRICARE briefing making it more focused towards care at Fort Carson versus a TRICARE overview.

DTIC

*Clinical Medicine; Prevention; Health*

**20030015769** Academy of Health Sciences (Army), Health Care Administration, Fort Sam Houston, TX USA

**TRICARE Senior Prime HEDIS Medicare Reporting: Exploring the Information Quality Model**

Baker, Darrell A.; Mar. 10, 2000; 89p; In English; Original contains color images

Report No.(s): AD-A409347; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

The use of the Health Plan Employer Data and Information Set (HEDIS) 3.0 provides the Military Health System (MHS) with a platform to demonstrate its strengths in delivering quality managed care to dual-eligible Medicare/ Department of Defense (DoD) beneficiaries and to locate areas for improvement. The MHS is tasked with reporting 22 HEDIS Medicare measures to the Health Care Financing Administration (HCFA) to comply with the TRICARE Senior Prime (TSP) demonstration guidelines. This study reports on the current information model used by the MHS to collect one of these measures: Beta Blocker Treatment After a Heart Attack. The current information model used by the MHS was found insufficient to allow for administrative reporting of the targeted measure. The study formulated an alternative conceptual information model based upon the fundamentals of Total Data Quality Management (TDQM). The two models were evaluated utilizing Wang's dimensions of information quality. The alternative conceptual model was found to be vastly superior to the current information model in every dimension. The concepts used to formulate the conceptual model, if applied, would allow the MHS to develop an effective information management system for the TSP demonstration.

DTIC

*Health; Management Systems; Defense Program; Information Management*

**20030015770** Wroclaw Univ., Poland

**The Project of the Telemedicine System for a Family Doctors' Practices**

Puchala, E.; Wozniak, M.; Oct. 25, 2001; 5p; In English

Report No.(s): AD-A409348; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The paper deals with a concept of a telemedicine system for the family doctor practices (FDP). The project offers the potential to improve: access to high-quality primary health care, education of family doctors and patients, This is a project which is realised in collaboration of two scientific partners: Department of Medical Informatics from Wroc3aw University of Technology Department of Family Medicine from Wroc3aw Medical University. For a start the telemedicine system will be prepared for the Lower Silesian territory in Poland.

DTIC

*Telemedicine; Procedures; Health; Education*

**20030015771** Illinois Inst. of Tech., Chicago, IL USA

**The Role of Usability Testing and Documentation in Medical Device Safety**

Feinberg, Susan G.; Feinberg, Barry N.; Oct. 25, 2001; 4p; In English; Original contains color illustrations; Papers from the 23rd Annual International Conference of the IEEE engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on CD-ROM

Report No.(s): AD-A409349; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Usability testing is a technique that can be used to identify problems users have with a device. If usability testing is employed early in the development cycle it can identify potential use-related problems and hazards so that they can be addressed early in the design and/or development process. The FDA's Center for Devices and Radiological Health has published a document that provides guidance on medical device use-safety and describes the benefits of usability testing to identify potential hazards. This paper describes the application of usability testing to the design development and use of a functional neuromuscular (cough) stimulator and the accompanying documentation. The purpose of the user testing has to observe participants using a device in a realistic situation. Iterative design and user testing is an effective way to (1) reduce or eliminate use-related hazards, (2) make an interface intuitive, (3) alert users to errors and (4) provide aids for safe operation.

DTIC

*Hazards; Neuromuscular Transmission; Radiology*

**20030015787** Rush-Presbyterian-Saint Luke's Medical Center, Chicago, IL USA

**Noninvasive Detection of Microdamage in Bone Annual Report, 10 Sep. 2001-10 Sep 2002**

Sumner, Dale R.; Oct. 2002; 7p; In English; Original contains color images

Contract(s)/Grant(s): DAMD17-01-1-0811

Report No.(s): AD-A409377; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

This concept exploration proposal seeks to determine if a novel x-ray technique called diffraction enhanced imaging, which provides dramatic gains in contrast over conventional radiography, can be used to identify microdamage in bone non-invasively. This technique has been used successfully in soft tissues, including recent studies by our group to detect damage in articular cartilage. Here, we plan to extend our work to studies relevant to microdamage accumulation and repair in bone. Interest in microdamage in bone comes in part from its likely role in the etiology of stress fractures. In addition, microdamage accumulation may contribute to osteoporotic fractures and loosening of dental or orthopedic implants. Our working hypothesis is that microdamage in bone can be detected non-invasively by diffraction enhanced imaging because this imaging modality expands the ability of x-rays to record refraction and scatter rejection (extinction) as well as absorption. No matter the spatial scale of the fracture feature, diffraction enhanced imaging has a contrast mechanism suited to make the feature visible. We have performed two sets of experiments to address Specific Aim 1, which focuses on using machined bone samples to determine if induced microdamage can be detected non-invasively. The results suggest that this may be possible and we are currently designing and carrying out an additional experiment to confirm these observations.

DTIC

*X Ray Diffraction; Bones; Fractures (Materials)*

**20030015791** Tulane Univ., Health Science Center, New Orleans, LA USA

**Phosphatidylinositol 3-Kinase and Protein Kinase C as Molecular Determinants of Chemoresistance in Breast Cancer Annual Report, 1 Jul. 2001-30 Jun. 2002**

Parker, Amanda P.; Beckman, Barbara S.; Burow, Matthew; Jul. 2002; 11p; In English; Original contains color images

Contract(s)/Grant(s): DAMD17-01-1-0432

Report No.(s): AD-A409382; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The goal of this project is to identify novel therapeutic strategies aimed at counteracting or reversing drug resistance in breast cancer. Chemotherapeutic drug resistance may result, in part, from a shift in the regulation of cellular mechanisms away from apoptosis to a more survival-oriented pathway. Two proteins that have been implicated as anti-apoptotic are protein kinase C and phosphatidylinositol 3-kinase. Although differential expression of these kinases have been linked to anti-apoptotic signaling mechanisms, the molecular details of upstream and downstream events are not well understood, and therefore elucidation of their mechanisms of action may represent a potential therapeutic target for breast cancer. Using an isogenic model system of estrogen receptor positive, apoptosis-sensitive and apoptosis-resistant breast cancer cell variants, this proposal aims to define the role of phosphatidylinositol 3-kinase and specific protein kinase C isoforms in cellular apoptotic signaling pathways. We have found that PKC  $\alpha$  and  $\delta$  isoforms are differentially expressed in our isogenic model. We are currently optimizing the use of green fluorescent protein-tagged, as well as constitutive-active and dominant-negative, PKC constructs, in order to better understand how PKC and PI3K may affect survival and apoptotic signaling in breast cancer.

DTIC

*Chemotherapy; Mammary Glands; Cancer*

**20030015796** Texas A&M Univ., College Station, TX USA

**Aryl-Hydrocarbon Receptor Based Antiestrogenicity of Diindolymethane Analogs Annual Report**

Lee, Jeong E.; Aug. 2002; 13p; In English

Contract(s)/Grant(s): DAMD17-99-1-9396

Report No.(s): AD-A409446; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Research in our laboratory has been focused on the mechanism of inhibitory aryl hydrocarbon (Ah) receptor-estrogen receptor  $\alpha$  (ER  $\alpha$ ) crosstalk in breast cancer cells, and results indicate that Ah receptor agonists inhibit estrogen (E2)-induced gene expression and cell proliferation. Moreover, 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD), a high affinity ligand for the Ah receptor, inhibits age-dependent and carcinogen-induced mammary tumor formation and growth in female Sprague-Dawley rats, and a recent study reported that women accidentally exposed to TCDD in Seveso, Italy, over 20 years ago exhibit lower incidence rates of breast and endometrial cancer. Studies on various structural classes of AhR agonists have identified alternate substituted (1,3,6,8- or 2,4,6,8-) alkyl polychlorinated dibenzofurans (PCDFs) and substituted diindolymethanes (DIMs) as selective Ah receptor modulators (SAhRMs) that are relative nontoxic but inhibit mammary tumor growth in rodent models. With financial

support from this grant, I have been investigating the indirect antiestrogenic activity of substituted DIMs and applications of these compounds for treating mammary cancer (5-7).

DTIC

*Mammary Glands; Cancer*

**20030015797** MacCallum (Peter) Cancer Inst., Melbourne, Australia

**Molecular Epidemiology of Ovarian Cancer Annual Report, 15 Aug. 2001-14 Aug 2002**

Bowtell, David; Green, Adele; Chenevix-Trench, Georgia; deFazio, Anna; Gertig, Dorota; Sep. 2002; 12p; In English

Contract(s)/Grant(s): DAMD17-01-1-0729

Report No.(s): AD-A409447; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The aim of this Program is to study the association between epidemiologic risk factors, low-risk genes, and histologic and novel molecular subtypes of ovarian cancer. Funding for the study began in September 2001 and we have since established systems for case ascertainment and recruitment at each of the collaborating sites. Data-collection instruments have been finalized and piloted (using local pilot funding) at the Royal Women's Hospital, Brisbane and at the Mater and Wesley Hospitals and 90% of eligible cases (82 patients) have consented to participate and completed the questionnaires. Project managers for the epidemiology and biospecimen cores have been appointed. A tracking database has been established and the biospecimen database substantially upgraded. SNP detection methodologies have been established. Our major task has been obtain IRC approval at 14 participating sites (complete except for one site), and subsequently obtaining HSRRB approval. Given the Australian context, some of the IRC's have not had an USA FWA in place. This has necessitated obtaining SPA at such sites. All centers in South Australia and NSW have both FWA and IRC approval, and we believe that the study will commence very soon in those states, pending final HSRRB approval.

DTIC

*Epidemiology; Cancer; Ovaries*

**20030015800** Nebraska Univ., Omaha, NE USA

**Determination of Catechol Estrogen Adducts by High-Performance Liquid Chromatography: Establishing Biomarkers for the Early Detection of Breast Cancer Final Report, 1 Jun. 1998-1 Jun 2002**

Stack, Douglas E.; Jul. 2002; 12p; In English

Contract(s)/Grant(s): DAMD17-98-1-8216

Report No.(s): AD-A409454; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

In order to better understand the role of estrogen metabolism as it relates to breast cancer etiology, a new analytical technique that can measure CE and CE-DNA adducts at low endogenous levels is being developed. This new technique is based on HPLC analysis of fluorescent probes specific for CE and CE-DNA adducts. An extraction procedure employing a solvent mixture of chloroform, dimethylformamide, and acetic acid was developed to extract CE-DNA adducts, CE, and MPEM from rat breast tissue. This extraction procedure involves homogenization of the tissue in 20 mL of the solvent mixture, removal of the solvent, followed by HPTc analysis. Reaction of alpha,alpha-dibromomalonamides occurs quickly with catechols, and this malonamide system is being developed to produce fluorescent probes for HPLC analysis. Reaction of N,N'-Bis-anthracen-9-ylmethyl-2,2-dibromo-malonamide with catechol results in ketal formation. The resulting product is highly fluorescent and can be detected at the low femtomole level. The aim of this work is to develop new biomarkers for the early detection of breast cancer.

DTIC

*Liquid Chromatography; Estrogens; Mammary Glands; Cancer*

**20030015804** NASA Johnson Space Center, Houston, TX USA

**Endothelium Preserving Microwave Treatment for Atherosclerosis**

Carl, James R., Inventor, NASA Johnson Space Center, USA; Arndt, Dickey, Inventor, NASA Johnson Space Center, USA; Fink, Patrick W., Inventor, NASA Johnson Space Center, USA; Beer, Reginald, Inventor, NASA Johnson Space Center, USA; Henry, Phillip D., Inventor, NASA Johnson Space Center, USA; Pacifico, Antonio, Inventor, NASA Johnson Space Center, USA; Raffoul, George W., Inventor, NASA Johnson Space Center, USA; Dec. 17, 2002; 23p; In English; Division of US-Patent-Appl-SN-129832, filed 5 Aug. 1998, which is a continuation-in-part of US-Patent-Appl-SN-641045, filed 17 Apr. 1996

Patent Info.: Filed 9 Feb. 2000; NASA-Case-MS-C-22724-5; US-Patent-6,496,736; US-Patent-Appl-SN-500538; US-Patent-Appl-SN-129832; US-Patent-Appl-SN-641045; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Method and apparatus are provided to treat atherosclerosis wherein the artery is partially closed by dilating the artery while preserving the vital and sensitive endothelial layer thereof. Microwave energy having a frequency from 3 GHz to 300 GHz is propagated into the arterial wall to produce a desired temperature profile therein at tissue depths sufficient for thermally necrosing connective tissue and softening fatty and waxy plaque while limiting heating of surrounding tissues including the endothelial layer and/or other healthy tissue, organs, and blood. The heating period for raising the temperature a potentially desired amount, about 20 C. within the atherosclerotic lesion may be less than about one second. In one embodiment of the invention, a radically beveled waveguide antenna is used to deliver microwave energy at frequencies from 25 GHz or 30 GHz to about 300 GHz and is focused towards a particular radial sector of the artery. Because the atherosclerotic lesions are often asymmetrically disposed, directable or focussed heating preserves healthy sectors of the artery and applies energy to the asymmetrically positioned lesion faster than a non-directed beam. A computer simulation predicts isothermic temperature profiles for the given conditions and may be used in selecting power, pulse duration, beam width, and frequency of operation to maximize energy deposition and control heat rise within the atherosclerotic lesion without harming healthy tissues or the sensitive endothelium cells.

Official Gazette of the U.S. Patent and Trademark Office

*Arteries; Arteriosclerosis; Endothelium; Microwaves; Cells (Biology)*

**20030015813** Johns Hopkins Univ., Dept. of Biomedical Engineering, Baltimore, MD USA

**Analysis of the Activation Propagation on Both Ventricles Using Tagged MRI**

Samli, A.; Ozturk, C.; Faris, O.; Wyman, B.; Oct. 25, 2001; 5p; In English; Papers from 23rd Annual International Conference of the IEEE Engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom.

Report No.(s): AD-A409459; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

MRI tagging created new opportunities for motion analysis within the body. With tagged cardiac MRI, detailed motion analysis has been previously shown; e. g. measurements of local strain of the heart could be obtained easily for normal and pathological hearts. In this study, we calculate the activation times using the local time-strain relationship and compute the propagation velocity of the activation for both chambers of the heart. Here, in this initial analysis, we obtained propagation velocities for four canine hearts paced either at the atrium or right ventricle. The first case provides a condition similar to the normal physiological activation. We show here for the first time an activation propagation speed over the right ventricle in vivo. The overall method provides a unique noninvasive method to examine the underlying electrical activation of the heart, but further studies are needed to establish its true clinical value.

DTIC

*Motion; Heart*

**20030015819** Toronto Univ., Inst. of Biomaterials and Biomedical Engineering, Ontario Canada

**Acceleration of Learning in Hybrid Neural Networks: A Novel Approach for the Design of Brain Chaosmakers**

Bardakjian, Berj L.; Chiu, Alan; Oct. 25, 2001; 5p; In English; Papers from the 23rd Annual International Conference of the IEEE engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom.

Report No.(s): AD-A409468; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Epileptic seizures correspond to episodes of increased rhythmicity of the normally chaotic activity in biological neural networks. We propose to use hybrid neural networks where artificial neural networks are used to control the biological neural networks by learning their different states. The learning is dramatically accelerated when using a conjugate gradient method in conjunction with the Fletcher-Reeves method of optimization.

DTIC

*Neural Nets; Brain; Epilepsy*

**20030015824** Children's Hospital of Los Angeles, Los Angeles, CA USA

**Identification of Oncogenes Cooperating in Murine Mammary Tumorigenesis Annual Report, 1 Jun. 2001-31 May 2002**

Lopez-Diego, Rocio S.; Shackelford, Gregory M.; Jun. 2002; 20p; In English

Contract(s)/Grant(s): DAMD17-00-1-0199

Report No.(s): AD-A409479; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

In order to identify and characterize additional novel or unexpected proto-oncogenes that, in addition to fibroblast growth factors (Fgfs) cooperate with Wnt1 in murine mammary tumorigenesis, we have generated MMTV-infected Wnt10b/ Fgfr2DN, Wnt1/Fgfr2DN and Wnt1/FgP bitransgenic mice. In the first two models, the Wnt oncogenic signal is constitutively overexpressed in their mammary gland, cooperative oncogenic Fgf signals should be abolished by the expression of a dominant-negative FOF

receptor (Fgfr2DN) The Wnt1/Fgf3 model displays constitutive overexpression of both Wnt and Fgfoncogenic signals. In all three models, only those cells carrying MMTV-insertionally activated cellular proto-oncogenes, other than Wnts and Fgfs, should have a growth advantage in the bitransgenic mammary gland. The clonal expansion of these cells leads to mammary tumorigenesis. As proposed, we have generated cohorts of 20-25 MMTV-infected Wnt1Ob/Fgfr2DN, Wnt1/Fgfr2DN and Wnt1/Fgf3 bitransgenic females. As controls, we have also generated uninfected bitransgenic cohort, as well as MMTV-infected and uninfected monotrausgenic female control groups. to date, multiple mammary adenocarcinomas have appeared in the MMTV-infected bitransgenic animals. These tumors appeared with a mean latency of 5.4 and 3 months in Wnt1/Fgfr2DN and Wnt1/Fgf3 females respectively. Wnt1Ob/Fgfr2DN tumor histopathology corresponded to papillary lobular, ductal, and metaplastic invasive carcinomas. Wnt1/Fgfr2DN tumors were mainly papillary carcinomas, and Wnt1/Fgf3 tumors displayed features of highly metastatic (to lungs) papillary carcinomas. At least 1OWnt1Ob/Fgfr2DN, 6Wnt1/Fgfr2DN and 1 Wnt1/Fgf3 tumors carry newly integrated MMTV proviruses. Our current efforts are to clone and identify these genes, and we are also screening for additional candidate tumors.

DTIC

*Mammary Glands; Cancer*

**20030015838** Nanyang Technological Univ., Nanyang, Singapore

**Classification of Endoscopic Image Based on Texture and Neural Network**

Wang, P.; Krishnan, S. M.; Kugean, C.; Tjoa, M. P.; Oct. 25, 2001; 6p; In English; Original contains color images; Papers from 23rd Annual International Conference of the IEEE Engineering in Medicine and Biology Society, Oct 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom, The original document contains color images

Report No.(s): AD-A409511; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Computerized processing of medical images can ease the search of the representative features in the images. The endoscopic images possess rich information expressed by texture. Regions affected by diseases, such as ulcer or coli, may have different texture features. The texture model implemented in this study is Local Binary Pattern (LBP) and a log-likelihood ratio, called the G-statistic, is used to evaluate the similarity of regions based on LBP.

DTIC

*Image Classification; Neural Nets; Textures; Pattern Recognition*

**20030015852** Aalborg Univ., Aalborg Denmark

**Investigation of Current Densities Produced by Surface Electrodes Using Finite Element Modeling and Current Density Imaging**

Patriciu, A.; DeMonte, T. P.; Joy, M. L.; Struijk, J. J.; Oct. 25, 2001; 5p; In English; Original contains color illustrations; Papers from the 23rd Annual International Conference of the IEEE engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on CD-ROM

Report No.(s): AD-A409543; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Designers of gel-type surface electrodes, used in medical applications such as pain relief and neuromuscular stimulation, require a more thorough understanding of current pathways in tissue in order to design more effective electrical stimulation systems. to investigate these pathways, a finite element model (FEM) was used to compute current density distributions produced by an electrode placed on the surface of a homogeneous, tissue-mimicking gel slab. The gel slab phantom was constructed and the current densities were measured using a recently developed technique called current density imaging (CDI). CDI uses the phase data produced by magnetic resonance imaging (MRI) as a measure of the magnetic fields produced by the externally applied current. The results of the FEM simulation and CDI measurements compare well. CDI has several potential advantages over conventional FEM techniques including: no requirement for knowledge of local tissue conductivities, low and constant computational overhead regardless of tissue complexity, and the potential to perform in-vivo measurements.

DTIC

*Current Density; Electrodes; Finite Element Method; Imaging Techniques; Mathematical Models; Neuromuscular Transmission*

**20030015853** Toronto General Hospital, Toronto, Ontario Canada

**Electro-Anatomical Four-Dimensional Mapping of Ventricular Tachycardia**

Panescu, Dorin; Nasir, Mansoon; Masse, Stephan; Sevaptisidis, Elias; Downar, Eugene; Oct. 25, 2001; 4p; In English; Original contains color illustrations; Papers from the 23rd Annual International Conference of the IEEE engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on CD-ROM

Report No.(s): AD-A409544; No Copyright; Avail: CASI; A01, Hardcopy

The objectives of this study were: 1) to reconstruct the ventricular 3-D geometry by processing intracardiac echo (ICE) images, 2) to reconstruct the nesting position and orientation of the mapping catheters inside the ventricle, 3) integrate the geometrical information with the cardiac activity data recorded with the catheter and 4) to provide anatomic localization of electrical events during clinical ventricular tachycardia (VT). We employed commercially available 64-electrode mapping catheters, ICE equipment, a custom designed EP recording system and custom reconstruction software. In vitro, the positions of basket catheter electrodes were identified correctly. During clinical use, the basket electrode positions were not identified reliably by ICE. However, the nesting position of the basket was identified correctly. The custom software integrated the geometrical information and cardiac activity data off line, during the procedure. Electrical events occurring during VT were correctly displayed on the reconstructed geometry.

DTIC

*Tachycardia; Anatomy; Electrocardiography; Mapping; Clinical Medicine*

**20030015861** NASA Johnson Space Center, Houston, TX USA

**Growth Stimulation of Biological Cells and Tissue by Electromagnetic Fields and Uses Thereof**

Wolf, David A., Inventor, NASA Johnson Space Center, USA; Goodwin, Thomas J., Inventor, NASA Johnson Space Center, USA; Nov. 26, 2002; 23p; In English

Patent Info.: Filed 2 Jun. 2000; NASA-Case-MS-C-22633-1; US-Patent-6,485,963; US-Patent-Appl-SN-587028; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The present invention provides systems for growing two or three dimensional mammalian cells within a culture medium facilitated by an electromagnetic field, and preferably, a time varying electromagnetic field. The cells, and culture medium are contained within a fixed or rotating culture vessel, and the electromagnetic field is emitted from at least one electrode. In one embodiment, the electrode is spaced from the vessel. The invention further provides methods to promote neural tissue regeneration by means of culturing the neural cells in the claimed system. In one embodiment, neuronal cells are grown within longitudinally extending tissue strands extending axially along and within electrodes comprising electrically conductive channels or guides through which a time varying electrical current is conducted, the conductive channels being positioned within a culture medium. Official Gazette of the U.S. Patent and Trademark Office

*Cells (Biology); Culture Techniques; Electromagnetic Fields; Stimulation; Tissues (Biology)*

**20030016546** Instituto Nacional de Pesquisas Espaciais, Sao Jose dos Campos, Brazil

**Radiation Use Efficiency and Harvest Index in Wheat Crop Under Drought Stress in Different Growth Stages *Radiometria de campo em Trigo Submetido a Estresse Hidrico em Diferentes Estadios do Desenvolvimento***

Moreira, Mauricio Alves, Instituto Nacional de Pesquisas Espaciais, Brazil; Filho, Rubens Angulo, Instituto Nacional de Pesquisas Espaciais, Brazil; Rudorff, Bernardo Friedrich Theodor, Instituto Nacional de Pesquisas Espaciais, Brazil; 2002; 96p; In Portuguese Report No.(s): INPE-8975-RPQ/731; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

During the winter season of 1995 a field experiment was conducted at the Areao Farm, College of Agriculture (ESALQ/USP) at Piracicaba, Sao Paulo State, to analyze the radiation use efficiency (e) and harvest index (HI) of the wheat cultivar IAC-287 'YACO' when the drought stress was applied in different growth stage. The experiment was a randomized complete block design: with five treatments and three replicates. The drought stress was applied during the tillering stage, during the booting stage, during the grain fill and during ripening. The use efficiency for fitomass production (E(sub F) was reduced in 22.8 and 15.4 % when the drought stress was applied during tillering stage and booting stage, respectively, of control. The drought stress, when applied during tillering stage, booting stage and grain fill stage reduced the grain production in 21.1; 22.2 and 22.2%, respectively, of control. When the drought stress was applied during grain fill stage reduced the HI in 19.1 % of control and, the HI was also significantly reduced when compared to control during booting stage (7.5%, p less than 0.05) and ripening stage (7.9%, p less than 0.05).

Author

*Plant Stress; Radiation; Farm Crops; Drought; Vegetative Index*

**20030016557** Austin Research Inst., Heidelberg, Australia

**Vaccine Development Against Novel Breast Cancer Antigens *Final Report, 2 Aug. 1999-31 Oct. 2002***

Apostolopoulos, Vasso; McKenzie, Ian; Nov. 2002; 19p; In English; Original contains color images

Contract(s)/Grant(s): DAMD17-99-1-9067

Report No.(s): AD-A409560; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Improvement in the treatments of breast cancer are required - at present, the foundations for therapy is still surgery, radiotherapy and cytotoxic drugs and added to this is hormonal manipulation and more recently the Herceptin antibody. However, the treatment is less than optimal with serious side effects occurring with chemotherapy and while the "cure" rate is steadily improving, it is appropriate to examine immunotherapy to give a major improvement and survival of patients with breast cancer. For immunotherapy to succeed two components are required a) antigens and b) delivery system. In this study, we identified a number of antigens which, at least initially, appeared to be over-expressed in breast cancer and which could be suitable targets - these included MUCI, Cripto, nm23, several oncogenes, ampheregulin, E(iF receptor and Her2/neu. This was an ambitious project and along the way several of these were discarded as not being sufficiently cancer specific to use and also the failure to be able to produce adequate amounts for study hindered some of the proposed antigens to be discontinued. Delivery systems today mostly rely on antigen encountering dendritic cells by chance and other adjuvants have been described which non-specifically heighten the immune response all of which have side effects. Furthermore, the treatment with advanced disease, seeking an enhanced immune response, is almost doomed to fail because of the poor health (immune status) of the patients. With this mind, we not only examined the role of mannan to target the mannose receptor of dendritic cells, but variations of this using ex vivo cells (outside the patient to avoid cross reactivity and the suppressive environment in the patient). We compared the mannan technology with other modes of immunization such as the prime boost technology, the use of antennapedia peptides for delivery and the use of the beads as carriers.

DTIC

*Vaccines; Antigens; Cancer; Mammary Glands; Immunology; Product Development*

**20030016558** Virginia Univ., Charlottesville, VA USA

**Chromatin Remodeling Function of BRCA1 and its Implication in Regulation of DNA Replication** *Final Report, 1 Sep. 1999-31 Aug. 2002*

Li, Rong; Sep. 2002; 39p; In English; Original contains color images

Contract(s)/Grant(s): DAMD17-99-1-9572

Report No.(s): AD-A409559; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Germ line mutations in BRCA1 confer elevated risks in the development of familial breast and ovarian cancers (1) (2). BRCA1 encodes a 1863-amino acid protein with a highly conserved RING finger domain at the amino terminus and two BRCT repeats at the extreme carboxyl terminus. While most disease-associated mutations of BRCA1 are predicted to result in gross function of the protein, 5-10% of the cancer-predisposing mutations cause single amino acid substitutions (3), many of which are located in the RING domain or BRCT repeats. It is generally assumed that both types of mutations lead to loss of the biological functions of the protein, however, several genotype-phenotype correlation studies suggest that BRCA1 mutations at different locations of the gene may confer different BRCA1-dependent cancer risks.

DTIC

*Deoxyribonucleic Acid; Mammary Glands; Cancer; Substitutes; Proteins*

**20030016559** Ecole Nationale Supérieure des Telecommunications, MAGE Info Processing Dept., Brest, France

**ECG Segmentation and P-Wave Feature Extraction: Application to Patients Prone to Atrial Fibrillation**

Lepage, Ronan; Boucher, Jean-Marc; Blanc, Jean-Jacques; Cornilly, Jean-Christophe; Oct. 25, 2001; 6p; In English; Papers from 23rd Annual International Conference of the IEEE Engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on CD-ROM

Report No.(s): AD-A409557; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

This paper presents an automatic analysis method of the P-wave, based on lead 11 of a 12 lead standard ECG, which will be applied to the detection of patients prone to atrial fibrillation (AF), one of the most frequent arrhythmias. It focuses first on the segmentation of the electrocardiogram P-wave, which is performed in two steps: first, detection of the QRS complexes, then association of a wavelet analysis method and a hidden Markov model to represent one beat of the signal. After segmentation, the P-wave is isolated and a set of parameters, which have the ability to detect patients prone to AF, is calculated from it. The detection efficiency is validated on an ECG database of 145 patients including a control group and a study group with documented AF. A discriminant analysis is applied and the results obtained show a specificity and a sensitivity between 65% and 70%.

DTIC

*Electrocardiography; Arrhythmia; Fibrillation; Discriminant Analysis (Statistics)*

**20030016560** Aalborg Univ., Center for Sensory-motor Interaction, Aalborg, Denmark

**Detecting Skin Burns Induced by Surface Electrodes**

Patriciu, A.; Yoshida, K.; DeMonte, T. P.; Joy, M. L.; Oct. 25, 2001; 4p; In English; Original contains color illustrations; Papers from the

23rd Annual International Conference of the IEEE engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on CD-ROM

Report No.(s): AD-A409556; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The origin of electrical burns under gel-type surface electrodes is a controversial topic that is not well understood. To investigate the phenomenon, we have developed an excised porcine skin+gel model. In the present paper, we describe methods to detect these burns in the skin+gel model in an effort to understand the genesis of these burns. Burns were induced by severe electrical stimulation and changes in the impedance spectra and current density measured. We found that the changes in impedance spectrum were characterized by significant drop in the low frequency (less than 1 kHz) impedance magnitude and the formation of wells in the skin. Low frequency current density imaging (LFCDI) revealed regions of high current density beneath the electrode before burns were induced suggesting the possibility of predicting the locations where wells from burns will form and the importance of current density and local tissue impedance in the formation of these burns.

DTIC

*Burns (Injuries); Detection; Electrodes; Imaging Techniques; Skin (Anatomy)*

**20030016561** Bonn Univ., Dept. of Epileptology, Germany

**Seizure Anticipation Techniques: State of the Art and Future Requirements**

Lehnertz, K.; Oct. 25, 2001; 4p; In English; Papers from 23rd Annual International Conference of the IEEE Engineering in Medicine and Biology Society, Oct 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on CD-ROM

Report No.(s): AD-A409555; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Recent research in seizure anticipation has shown that "pre-seizure states" can be detected several minutes in advance from analysis of EEG time series. This time frame would allow development and testing of specific seizure prevention techniques. Thus, there is now growing interest to bring these analysis techniques to a broader application in hospitals. Similar demands come from the industry as there is strong interest to incorporate analysis techniques into EEG acquisition systems and, moreover, to develop miniaturized possibly implantable devices for seizure anticipation and possibly prevention. This report gives an overview of the state of the art of seizure anticipation techniques and addresses future requirements to allow realization of seizure anticipation devices.

DTIC

*Electroencephalography; Disorders; Convulsions; Implantation*

**20030016563** Bogazici Univ., Istanbul, Turkey

**Computer Simulation of Differential Kinetics of MAPK Activation Upon EGF receptor Overexpression**

Aksan, I.; Sen, M.; Araz, M. K.; Kurnaz, M. L.; Oct. 25, 2001; 5p; In English; Papers from the 23rd Annual International Conference of the IEEE engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on CD-ROM

Report No.(s): AD-A409553; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Everyday cells encounter various stimuli ranging from growth signals to bacterial infectious to UV insult to death signals. They must somehow receive these signals, interpret them, integrate different stimuli, and generate the required output. They can do so by an intricate mechanism named intracellular signal transduction. There are various signal transduction pathways within a cell, each of which are designed for a particular stimulus, and all of which can crosstalk among themselves for the careful integration of all stimuli. In this report, only one of these pathways, the mitogen-activated protein kinase (MAPK) pathway has been simulated. This pathway is activated upon binding of growth factors to their respective cell surface-bound receptors. Activated receptors relay the incoming signal to the cell interior via a cascade of proteins, which are thought to be involved in both the amplification of the signal, and the specificity of the pathway. A generic MAPK pathway activated by the EGF (epidermal growth factor) and the effect of receptor overexpression has been studied, and consistent with experimental evidence, it is shown that the number of EGF receptors on the cell surface is a key factor in the response generated by the pathway.

DTIC

*Computerized Simulation; Phosphors; Kinetics; Receptors (Physiology)*

**20030016564** Bogazici Univ., Istanbul, Turkey

**Three Dimensional Representation of Amino Acid Characteristics**

Sezerman, O. U.; Islamaj, R.; Alpaydin, E.; Oct. 25, 2001; 5p; In English; Original contains color illustrations; Papers from the 23rd Annual International Conference of the IEEE engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on CD-ROM

Report No.(s): AD-A409552; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Amino acid substitution matrices which shows the similarity scores between pairs of amino acids have been widely used in protein sequence alignments. These matrices are based on the Dayhoff model of evolutionary substitution rates. Using machine learning techniques we obtained three dimensional representations of these matrices while preserving most of the information obtained in the matrices. Vector representation of amino acids has many applications in pattern recognition.

DTIC

*Vector Analysis; Amino Acids; Three Dimensional Models; Machine Learning*

**20030016600** Cold Spring Harbor Lab., New York, NY USA

**Investigation of the Causes of Breast Cancer at the Cellular Level: Isolation of In Vivo Binding Sites of the Human Origin Recognition Complex Annual Report, 1 Jul. 1999-1 Jul 2002**

Mendez, Juan; Stillman, Bruce; Aug. 2002; 25p; In English

Contract(s)/Grant(s): DAMD17-99-1-9138

Report No.(s): AD-A409474; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We study the process of DNA replication in proliferating human cells. Our efforts are directed to the identification and characterization of proteins that promote DNA replication (initiators') as well as the DNA sequences recognized by them ('replicators'). We have focused in a group of initiator proteins called Origin Recognition Complex (ORC), CDC6, and the Mini-Chromosome Maintenance (MCM) proteins. hOrclp, the largest subunit of ORC, appears to be a critical factor for the coordination of DNA replication with the cell division cycle. hOrclp levels are higher between the exit of mitosis and the end of G1, the stage at which initiator proteins are assembled at the origins of replication. As cells enter S phase, hOrclp is polyubiquitinated on chromatin and degraded by the proteasome. hOrclp destruction is signaled in part by the SCFskp2 ubiquitin conjugating machinery. The controlled destruction of hOrclp likely contributes to avoid DNA overreplication, a common phenomenon in cancer cells. Our efforts to identify DNA replicator sequences using chromatin immunoprecipitation (ChIP) assays support the hypothesis that human origins of replication may not be defined by short specific DNA sequences but rather by higher-order chromatin structures.

DTIC

*Cancer; Mammary Glands*

**20030016702** Lawrence Livermore National Lab., Livermore, CA USA

**Part 1: Participatory Ergonomics Approach to Waste Container Handling Utilizing a Multidisciplinary Team**

Zalk, D. M.; Biggs, T. W.; Perry, C. M.; Tageson, R.; Tittiranonda, P.; Feb. 07, 2000; 10p; In English

Report No.(s): DE2002-792806; UCRL-JC-137645-P1; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

This multidisciplinary team approach to waste container handling, developed within the Grassroots Ergonomics process, presents participatory ergonomic interpretations of quantitative and qualitative aspects of this process resulting in a peer developed training. The lower back, shoulders, and wrists were identified as frequently injured areas, so these working postures were a primary focus for the creation of the workers' training. Handling procedures were analyzed by the team to identify common cycles involving one 5 gallon (60 pounds), two 5 gallons (60 and 54 pounds), 30 gallon (216 pounds), and 55 gallon (482 pounds) containers: lowering from transporting to/from transport vehicles, loading/unloading on transport vehicles, and loading onto pallet. Eleven experienced waste container handlers participated in this field analysis. Ergonomic exposure assessment tools measuring these field activities included posture analysis, posture targeting, Lumbar Motion Monitor (LMM), and surface electromyography (sEMG) for the erector spinae, infraspinatus, and upper trapezius muscles. Posture analysis indicates that waste container handlers maintained non-neutral lower back postures (flexion, lateral bending, and rotation) for a mean of 51.7% of the time across all activities. The right wrist was in nonneutral postures (radial, ulnar, extension, and flexion) a mean of 30.5% of the time and the left wrist 31.4%. Non-neutral shoulder postures (elevation) were the least common, occurring 17.6% and 14.0% of the time in the right and left shoulders respectively. For training applications, each cycle had its own synchronized posture analysis and posture target diagram. Visual interpretations relating to the peak force modifications of the posture target diagrams proved to be invaluable for the workers' understanding of LMM and sEMG results (refer to Part II). Results were reviewed by the team's field technicians and their interpretations were developed into ergonomic training that address the issues originally raised. This

training includes intervention methods, ergonomic tools used, damage acquired, and effects of waste container handling techniques on lower back, shoulder, and wrists and methods to help proactively reduce injuries associated with this profession.

NTIS

*Waste Management; Human Factors Engineering*

**20030017877** Osaka City Univ., Dept. of Physical Electronics and Information, Japan

**On the Generating Factor of Nonlinear Dielectric Responses of *Saccharomyces Cerevisiae***

Inuishi, Tsutomu, Osaka City Univ., Japan; Muraji, Masafumi, Osaka City Univ., Japan; Tsujimoto, Hiroaki, Osaka City Univ., Japan; Memoirs of the Faculty of Engineering, Osaka City University; December 2002; ISSN 0078-6659; Volume 43, pp. 13-17; In English; Copyright; Avail: Issuing Activity

The harmonies of response wave based on the nonlinear dielectric properties of yeast cells have particular patterns for biological activity. The method is a novel technique for determining the activity of living cells. In this paper, we examined the generating factor of the nonlinear dielectric responses by comparing the results in the case where yeast cells exist near the electrodes of an electrochemical cell with those in the case where yeast cells do not. It was ascertained that nonlinear dielectric responses were induced according to biological activities.

Author

*Dielectric Properties; Nonlinearity; Activity (Biology); Electrodes*

**20030017892** Sichuan Univ., School of Basic Medicine and Forensic, Chengdu, China

**Circadian Expression of mPER1 in Cultured Murine Myocardocytes and Effects of Melatonin on It**

Zhou, Bei-Yi, Sichuan Univ., China; Tao, Da-Chang, Sichuan Univ., China; Teng, Qi-Zhi, Sichuan Univ., China; Wang, Zheng-Rong, Sichuan Univ., China; Space Medicine and Medical Engineering; December 2002; ISSN 1002-0837; Volume 15, No. 6, pp. 448-449; In Chinese; Copyright; Avail: Issuing Activity

The objective of this research was to investigate the mechanism of beating in cultured myocardocytes through analyzing mPER1 expression and effect of melatonin on it. Immunohistochemistry and melatonin interference test were employed. mPER1 expression in cultured myocardocytes showed circadian pattern, its acrophase was 15:20, its three consecutive daily average period length was approximately 23 h. Melatonin had little effects on its amplitude and period, but results in its phase delayed. The observation in this study was similar to those that we previously observed in cultured murine myocardocytes beating. Oscillation of mPER1 gene is one of the important reasons which cause murine myocardocytes circadian beating. Melatonin acts as 'Zeitgeber' regulating mPER1 gene expression.

Author

*Gene Expression; Proteins; Rodents; Hormones; Heart Diseases*

**20030017983** Institute of Space Medico-Engineering, Beijing, China

**Effects of +Gz Load on Energy Metabolism of Brain Tissue in Rats**

Wu, Bin, Institute of Space Medico-Engineering, China; Xie, Bao-Sheng, Institute of Space Medico-Engineering, China; You, Guang-Xing, Institute of Space Medico-Engineering, China; Liu, Xing-Hua, Institute of Space Medico-Engineering, China; Lu, Sheng-Qiang, Institute of Space Medico-Engineering, China; Huang, Wei-Fen, Institute of Space Medico-Engineering, China; Space Medicine and Medical Engineering; December 2002; ISSN 1002-0837; Volume 15, No. 6, pp. 406-409; In Chinese; Copyright; Avail: Issuing Activity

To observe the changes of energy metabolism of brain tissue in rats under + Gx loads, and to explore its possible role in changes of brain function and work efficiency induced by + Gx stress. Forty-five male Wistar rats were randomly divided into control, + 5 Gx, + 10 Gx, + 15 Gx and + 20 Gx group. Each group was exposed to the corresponding G value for 3 min. After that, cortical adenosine triphosphate (ATP), adenosine diphosphate (ADP), adenosine monophosphate (AMP) and lactic acid (LA) content, lactate dehydrogenase (LDH) activity were measured. Compared with the control group, the cortical LA content increased significantly after + 5 Gx, + 10 Gx, + 15 Gx and + 20 Gx exposure (P less than 0.01). Cortical ADP content and ratio of ADP/AMP and AMP/ATP increased significantly after + 10 Gx, + 15 Gx and + 20 Gx exposure (P less than 0.01), whereas ATP content, energy charge and LDH activity decreased significantly (P less than 0.05 or 0.01). Cortical AMP content increased significantly after + 15 Gx and + 20 Gx exposure (P less than 0.05 and 0.01). It is suggested that + Gx load can result in obvious depression of brain energy metabolism, which could be an important reason for the change of brain function and work efficiency induced by + Gx stress.

Author

*Brain; Stress (Physiology); Metabolism; Acceleration Stresses (Physiology); Lactic Acid*

**20030018106** Computer Sciences Corp., Moffett Field, CA USA

**Influence of Disorder on DNA Conductance**

Adessi, Christophe, NASA Ames Research Center, USA; Anantram, M. P., Computer Sciences Corp., USA; [2003]; 11p; In English

Contract(s)/Grant(s): NASA Order A-61812-D; NCC2-5407; RTOP 704-05-40; DTTS59-99-D-00437; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Disorder along a DNA strand due to non uniformity associated with the counter ion type and location, and in rise and twist are investigated using density functional theory. We then model the conductance through a poly(G) DNA strand by including the influence of disorder. We show that the conductance drops by a few orders of magnitude between typical lengths of 10 and 100 nm. Such a decrease occurs with on-site potential disorder that is larger than 100 meV.

Author

*Deoxyribonucleic Acid; Electrical Resistivity*

**20030018251** Air Force General Hospital, Dept. of Molecular Biology, Beijing, China

**Construction of a cDNA Subtractive Library of Rat Brain after Repeated +Gz Exposure**

Cai, Qing, Air Force General Hospital, China; Liu, Hong-Jin, Air Force General Hospital, China; Lin, Kai, Air Force General Hospital, China; Jiang, Jian-Dong, Air Force General Hospital, China; Zhu, Mei-Cai, Air Force General Hospital, China; Space Medicine and Medical Engineering; December 2002; ISSN 1002-0837; Volume 15, No. 6, pp. 415-418; In Chinese; Copyright; Avail: Issuing Activity

To construct a cDNA subtractive library of rat brain after repeated + Gz exposures with suppression subtractive hybridization (SSH). Wister rats were randomly divided into control group and repeated + Gz exposure group. Using an animal centrifuge, control rats were exposed to + 1 Gz and exposure rats were exposed to + 10 Gz for three times, each for 1 min with 30 min inter-vat in between. Brains were taken 6 h after the last centrifuge run and Poly( A) + RNA were isolated. Moreover, single-strand cDNAs and double-strand cDNAs were synthesized in turn. After Rsa I enzyme restriction, + Gz exposure rat brain cDNAs were divided into two groups and ligated to the specific adaptor I and adaptor 2R, respectively. Then + Gz exposure rat brain cDNAs were hybridized with the control rat brain cDNA twice and underwent nested PCR twice. The PCR product was ligated with T/A plasmid vectors to set up the subtractive library. Result The cDNA subtractive library of rat brain after repeated + Gz exposures with high subtractive efficiency was set up successfully. The highly efficient cDNA subtractive library may provide a solid foundation for screening and cloning differentially expressed genes in rat brain after repeated exposures to + Gz.

Author

*Ribonucleic Acids; Brain; Cloning (Biology); Stress (Physiology)*

**20030018260** Osaka City Univ., Dept. of Physical Electronics and Information, Japan

**Measurement System of Low Glucose Concentration During the Cultivation of Yeast Cells**

Kishimoto, Tomokazu, Osaka City Univ., Japan; Hara, Seiichi, Osaka City Univ., Japan; Muraji, Masafumi, Osaka City Univ., Japan; Tsujimoto, Hiroaki, Osaka City Univ., Japan; Azuma, Masayuki, Osaka City Univ., Japan; Ooshima, Hiroshi, Osaka City Univ., Japan; Memoirs of the Faculty of Engineering, Osaka City University; December 2002; ISSN 0078-6659; Volume 43, pp. 19-23; In English; Copyright; Avail: Issuing Activity

A yeast cell changes an active state in accordance with glucose concentration in a culture medium. Below a certain critical glucose concentration under aerobic conditions, the yeast respire. Exceeding its value, the yeast changes an active state to fermentation. The aim of our study is to maintain the state of respiration and fermentation of yeast artificially. And so, a glucose sensor was needed to satisfy with respiration condition. In this study, we tried to construct the glucose sensor which was to measure glucose concentrations in very low region for a long time and to maintain quasi realtime measurement. The sensor was constructed using the phenomena of light emission by luminol, we evaluated the sensitivity, stability and reliability of it. The sensor was robust against outer disturbances, and had an influence by flow rate of solution, and dialysis rate. A detailed explanation of aerobic conditions and of reaction principle of the constructed glucose sensor will be presented here. And then, some basic characteristics of the glucose sensor will be shown here as well.

Author

*Glucose; Culture Techniques; Fermentation; Flow Velocity; Low Concentrations*

**20030018263** Institute of Space Medico-Engineering, Beijing, China

**Advances in Monoclonal Antibody Researches**

Yang, Tang-Bin, Institute of Space Medico-Engineering, China; Qu, Li-Na, Institute of Space Medico-Engineering, China; Space Medicine and Medical Engineering; December 2002; ISSN 1002-0837; Volume 15, No. 6, pp. 460-464; In Chinese; Copyright; Avail: Issuing Activity

Monoclonal antibody techniques are very important tools in modern life science research. Despite extensive research efforts paid in recent years, and promising results yielded in the study on the structure and function of genes and proteins, there is still a great need for further researches on the definition, principle and applicability of some immunological methods. This review gives an overview of the advances in immunological researches, including DNA immunization, cellular immunization and preparation of monoclonal antibodies. Using methods of modern molecular immunology, such as genetic immunization, cellular immunization, subtractive immunization and repetitive immunization multiple sites (RIMMS), to construct eukaryotic expression vector and to prepare high-affinity monoclonal antibodies in short time, the conventional method which is time-consuming and laborious could be improved. It is meaningful to the field of basic research and application, such as proteomics, biochip, clinical medicine and diagnosis and therapy of diseases.

Author

*Antibodies; Deoxyribonucleic Acid; Immunology*

**20030018264** Fourth Military Medical Univ., Dept. of Aerospace Medicine, Xi'an, China

**Effects of Simulated Weightlessness on Pressure-Volume Relationships of Femoral Vein of New Zealand Rabbits**

Yue, Yong, Fourth Military Medical Univ., China; Yao, Yong-Jie, Fourth Military Medical Univ., China; Xie, Xiao-Ping, Fourth Military Medical Univ., China; Wang, Bing, Fourth Military Medical Univ., China; Zhu, Qing-Sheng, Fourth Military Medical Univ., China; Wu, Xing-Yu, Fourth Military Medical Univ., China; Space Medicine and Medical Engineering; December 2002; ISSN 1002-0837; Volume 15, No. 6, pp. 410-414; In Chinese; Copyright; Avail: Issuing Activity

To observe the changes of pressure-volume relationships of rabbit femoral veins and their structural changes caused by simulated weightlessness. Head-Down Tilt(HDT) - 20 deg rabbit model was used to simulate weightlessness. Twenty four healthy male New Zealand Rabbits were randomly divided into 21 d HDT group, 10 d HDT group and control group, (8 in each group). Pressure-volume ( P-V) relationship of rabbits femoral veins was measured and the microstructure of the veins was observed. The femoral vein P-V relationship curves of HDT groups showed a larger volume change ratio than that of control group. This change was that 21 d HDT group was even more obvious than that of HDT-10 d group. B1 and B2 in quadratic equations of 21 d HDT group were significantly higher than the values of both 10 d HDT group and control group during expansion ( inflow) and collapse (outflow) (P less than 0. 01). The result of histological examination showed that the contents and structure of femoral vein wall of HDT-rabbits changed significantly. Endothelial cells of femoral vein became short and columnar or cubic, some of which fell off. Smooth muscle layer became thinner. Femoral venous compliance increased after weightlessness-simulation and the femoral venous compliance in 21d-HDT rabbits increased more obviously than that in 10 d-HDT rabbits. The structure of femoral vein wall had changed obviously.

Author

*Weightlessness Simulation; Veins; Microstructure; Physiological Effects*

**20030018450** NASA Ames Research Center, Moffett Field, CA USA

**Artificial Immune System Approaches for Aerospace Applications**

KrishnaKumar, Kalmanje, NASA Ames Research Center, USA; Dec. 20, 2002; 12p; In English; 41st Aerospace Sciences Meeting and Exhibit, 6-9 Jan. 2003, Reno, NV, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA  
Contract(s)/Grant(s): RTOP 704-30-62

Report No.(s): AIAA Paper 2003-0457; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Artificial Immune Systems (AIS) combine a priori knowledge with the adapting capabilities of biological immune system to provide a powerful alternative to currently available techniques for pattern recognition, modeling, design, and control. Immunology is the science of built-in defense mechanisms that are present in all living beings to protect against external attacks. A biological immune system can be thought of as a robust, adaptive system that is capable of dealing with an enormous variety of disturbances and uncertainties. Biological immune systems use a finite number of discrete "building blocks" to achieve this adaptiveness. These building blocks can be thought of as pieces of a puzzle which must be put together in a specific way-to neutralize, remove, or destroy each unique disturbance the system encounters. In this paper, we outline AIS models that are immediately applicable to aerospace problems and identify application areas that need further investigation.

Author

*Aerospace Engineering; Immune Systems; Artificial Intelligence; Systems Engineering; Adaptive Control; Algorithms*

52  
**AEROSPACE MEDICINE**

*Includes the biological and physiological effects of atmospheric and space flight (weightlessness, space radiation, acceleration, and altitude stress) on the human being; and the prevention of adverse effects on those environments. For psychological and behavioral effects of aerospace environments see 53 Behavioral Science. For the effects of space on animals and plants see 51 Life Sciences.*

**20030014714** NASA Ames Research Center, Moffett Field, CA USA

**Ophthalmological Applications of Carbon Nanotube Nanotechnology**

Loftus, David, NASA Ames Research Center, USA; [2002]; 4p; In English; NanoSig, 17-18 Oct. 2002, Unknown; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The development of an implantable device consisting of an array of carbon nanotubes on a silicon chip for restoration of vision in patients with macular degeneration and other retinal disorders is presented. The use of carbon nanotube bucky paper for retinal cell transplantation is proposed. This paper is in viewgraph form.

CASI

*Implantation; Carbon Nanotubes; Ophthalmology; Clinical Medicine; Vision*

**20030015440** Monash Univ., Clayton Australia

**The Use of Extremely Low Frequencies (ELF) in Pulsed Form (PELF) for Therapeutic Use: A Pilot Study**

Baldi, Emilio; Oct. 25, 2001; 5p; In English; Original contains color images  
Report No.(s): AD-A409410; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Following a previous investigation on the therapeutic effects of Extremely Low Frequency in pulsed form - Pulsed Extremely Low Frequency (PELF) 1 - this research explores the possibility of detecting the effects of PELF on the biological system by the use of the Heart Rate Variability (HRV) analysis. There is no overall change in HRV in presence of very weak - less than 25  $\mu$ T - PELF. However when the HRV is considered together with Heart Rate (HR) and Blood Pressure (BP) some interrelation can be detected.

DTIC

*Extremely Low Frequencies; Therapy*

**20030015820** Tsinghua Univ., Inst. of Biomedical Engineering, Beijing, China

**Reduction of the Decorrelation Effect Due to Tissue Lateral Displacement by 2-D Spatial Comprehensive Correlation in Elastography**

Ding, Chuxiong; Bai, Jing; Oct. 25, 2001; 5p; In English; Papers from the 23rd Annual International Conference of the IEEE engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom

Report No.(s): AD-A409469; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The cross-correlation based ultrasonic elastography is limited for application due to distortion of the echo waveform by tissue lateral deformation during axial compression. To reduce this kind of decorrelation effect, a time-efficient method called 2-D Spatial Comprehensive Correlation algorithm is proposed in this article. The basic idea of this method is to combine spatial adjacent cross-correlation functions as a comprehensive time shift estimator. Simulation model based on finite element analysis is applied to evaluate the method proposed in this work. Results indicate that this method can reduce the decorrelation effect of tissue lateral displacement with less increase of computation.

DTIC

*Spatial Distribution; Sonograms; Cross Correlation; Ultrasonics*

**20030015822** Boston Univ., Neuromuscular Research Center, Boston, MA USA

**Hypothesis Testing with a Computer Model for Force Production in Muscle**

Erim, Z.; Aghera, A.; Oct. 25, 2001; 5p; In English; Papers from the 23rd Annual International Conference of the IEEE engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom.

Report No.(s): AD-A409471; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

A computer model was designed based on the concept of common drive which suggests that motor units (group of muscle fibers and the single alpha-motoneuron that innervates them) in a muscle are controlled by a common input to the entire motoneuron pool. Where possible, the model utilized experimentally determined data and supplemented these with findings reported in the literature. It was validated by matching the simulated mean firing rates, power spectra, and compound muscle force

outputs to that produced by data from the Tibialis Anterior muscle. The model was implemented using Matlab's % SIMULINK % tool. In this form, the model allows easy modification of parameters to allow for virtual experimentation that would otherwise be impossible with human or animal models. The developed model was used to evaluate a commonly used technique, spike-triggered averaging (STA), to estimate the twitch force of an individual motor unit. It was concluded that STA has the potential to produce valid estimates only at firing rates below 3 pulses per second which are physiologically unfeasible. Simulations suggest that the effects of common drive on reliable MU twitch estimation may not be as extensive as initially expected. Additionally, hypotheses regarding the effect of various mechanical characteristics under certain physiological paradigms such as hand dominance or fatigue on the electrical properties can be investigated using the model.

DTIC

*Computerized Simulation; Power Spectra; Electrical Properties*

**20030015823** Orleans Univ., Lab. Vision Et Robotique, France

**Correction of Zoomed Morphology-Based Interpolation of Contours**

Migeon, Bruno; Rosenberger, Christophe; Marche, Pierre; Oct. 25, 2001; 5p; In English; Papers from the 23rd Annual International Conference of the IEEE engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom

Report No.(s): AD-A409472; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

In medical imaging, a 3D object must often be reconstructed from serial cross-sections. Usually, the cross-sections are not closely spaced so that interpolation is needed to solve the problem of anisotropy. Different interpolation techniques exist, applied either on slices or on objects. Recently, a new contour interpolation method based on a zooming transform and on mathematical morphology has been developed. Thanks to the zooming transform, it works in any case. But, the obtained results are bigger and not so smooth as one could wish. This paper proposes a correction of the method in order to avoid so big results.

DTIC

*Morphology; Anisotropy; Interpolation; Medical Services; Contours*

**20030015848** Army Research Lab., Human Research and Engineering Directorate, Aberdeen Proving Ground, MD USA

**The Effects of Physical Exertion on Cognitive Performance Final Report**

Krausman, Andrea S.; Crowell III, Harrison P.; Wilson, Rhoda M.; Nov. 2002; 49p; In English; Original contains color images. Report No.(s): AD-A409534; ARL-TR-2844; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This study examined the cognitive and physiological performance of soldiers as they exercised on a treadmill at various grades. Twelve soldiers walked at 1.56 m/sec on three grades, 0%, 3.5%, and 7.0%. The cognitive tasks performed by the soldiers were taken from the Walter Reed Performance Assessment Battery. The tasks chosen for this study included two reaction time tasks, an arithmetic task, and a decision-making task. Three measures were used to evaluate performance of the cognitive tasks: accuracy (percent correct), response time (responses per minute), and throughput (hits per minute). The physiological variables were heart rate and rating of perceived exertion. The findings of the research strongly support the fact that physical exertion does impact cognitive performance. Results indicate that the physical exertion facilitated performance of the two reaction time tasks and the decision-making task. Performance of the arithmetic task was degraded. The physiological results were compatible with those of progressive exercise.

DTIC

*Human Performance; Physiological Effects; Cognitive Psychology; Physical Exercise*

**20030015854** Poitiers Univ., France

**Experimental Study of Blood Laminar Flow Through a Stented Artery**

Benard, N.; Coisne, D.; Perrault, R.; Oct. 25, 2001; 4p; In English; Papers from the 23rd Annual International Conference of the IEEE engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on CD-ROM

Report No.(s): AD-A409545; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The objective of this research is to study the blood flow close to the wall of a stented artery. Indeed, previous works have showed that the restenosis phenomenon is induced by the endothelial cells stimulation due to the wall shear stress values. The coronary angioplasty is responsible of wall shear stress modification, mainly between the stent struts, at the inlet and the outlet of the endoprosthesis. That is why, to study the flow disturbances through a stented section, we built an in vitro model reproducing the struts shapes of a marketed endoprosthesis. The experimental artery, is composed of a see-through square section vein, which reproduce the struts design with a magnitude of 100. A programmable pump provide a steady or a pulsatile flow. by using the

velocimetry per imagery of particle (PIV) optical method we have explored the flow between and over the stent branches, in order to assess and to quantify the wall shear stress and to locate the interesting zones.

DTIC

*Arteries; Blood Flow; Laminar Flow; Blood Circulation; Cardiology*

**20030015856** Florence Medical Ltd., Kefar Saba, Israel

**A Method for Estimating the Physiological Significance of Each of Serial Vascular Lesions**

Shalman, E.; Einav, S.; Oct. 25, 2001; 3p; In English; Papers from 23rd Annual International Conference of the IEEE Engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on CD-ROM

Report No.(s): AD-A409548; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The physiological severity of a stenosis is determined by its fractional flow reserve (FFR). Coronary arteriosclerosis is a diffuse disease and it is not uncommon for 2-3 serial lesions to be observed in the same vessel. Direct measurement of the physiological severity of each lesion is impossible due to the homodynamic interaction between them. The "true FFR" of a given lesion is defined as the FFR that would be measured if of other stenosis in the same vessel were absent.

DTIC

*Arteriosclerosis; Cardiovascular System; Heart; Lesions; Physiology*

**20030015858** Zhejiang Univ., China

**A New Magnetic Device for the Identification of Endotracheal Tube Position**

Pan, Weijiang; Lou, Jingzhi; Zhang, Y. T.; Jin, Xiaofen; Oct. 25, 2001; 5p; In English; Papers from the 23rd Annual International Conference of the IEEE engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom

Report No.(s): AD-A409550; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

A new device for detecting the position of endotracheal tube is presented in this paper. This device consists of a high sensitive linear Hall-effect sensor and a newly designed endotracheal tube in which two small magnets are embedded. The Hall-effect sensor can be placed on the skin of neck over the vocal cord to detect the position of endotracheal tube by measuring the strength of its magnetic field when the magnet on tube passes through the glottis during intubation. The results of our clinical tests on 38 cases of endotracheal intubation and 15 controls of esophageal intubation show that the device is sensitive to verify the esophageal intubation, and that it provides a useful means for clinician to control the inserted length easily. Due to its unique principle of operation, the detector can be applied to all kinds of patients, especially in pre-hospital sites.

DTIC

*Trachea; Esophagus; Magnets; Position (Location); Mechanical Devices*

**20030016611** Civil Aerospace Medical Inst., Oklahoma City, OK USA

**Index to FAA Office of Aerospace Medicine Reports: 1961 Through 2002 Final Report, 1961-2002**

Collins, William E., Civil Aerospace Medical Inst., USA; Wayda, Michael E., Civil Aerospace Medical Inst., USA; January 2003; 98p; In English

Report No.(s): DOT/FAA/AM-03/1; No Copyright; Avail: CASI; A05, Hardcopy; A02, Microfiche

An index to Federal Aviation Administration Office of Aerospace Medicine Reports (1964-2002) and Civil Aeromedical Institute Reports (1961-1963) is presented for those engaged in aviation medicine and related activities. The index lists all FAA Aerospace Medicine technical reports published from 1961 through 2002: chronologically, alphabetically by author, and alphabetically by subject. A foreword relates historical aspects of the Civil Aerospace Medical Institute's 40 years of service, describes the index's sections, and explains how to obtain copies of published Office of Aerospace Medicine technical reports.

Author

*Aerospace Medicine; Reports*

**20030017889** Academy of Military Medical Sciences, Inst. of Medical Equipment, Tianjin, China

**A Vertical Vibration Model of Human Body in Supine Position**

Sun, Jing-Gong, Academy of Military Medical Sciences, China; Fu, Niu, Academy of Military Medical Sciences, China; Qi, Jian-Cheng, Academy of Military Medical Sciences, China; Li, Ruo-Xin, Academy of Military Medical Sciences, China; Space Medicine and Medical Engineering; December 2002; ISSN 1002-0837; Volume 15, No. 6, pp. 428-432; In Chinese; Copyright; Avail: Issuing Activity

To establish the models of head, abdomen, and chest of supine human body respectively under vertical vibration. The mechanical impedance of 12 healthy volunteers aged 24 - 56 was measured under vertical white noise stimulus in the frequency range of 2 - 35 Hz. to explain these findings, the model of head was proposed, the models of abdomen and chest were computed by way of an optimization procedure. The models of abdomen and chest are three-degree-of-freedom and the head is rigid. The mechanical impedance of the supine human body is linear and sole. The established models of head, abdomen and chest of supine human body when subjected to vertical vibration are useful for calculating and evaluating the comfort of supine human body under whole-body vibration.

Author

*Mechanical Impedance; Supine Position; Human Body; Models; Computer Aided Design; Vibration*

**20030018250** Institute of Space Medico-Engineering, Beijing, China

**Effects of Head Down Tilt on Intra-ocular Pressure, Near Vision, and Visual Field and the Protection Effect of Chinese Herbs**

Xu, Xin, Institute of Space Medico-Engineering, China; Xu, Zhi-Ming, Institute of Space Medico-Engineering, China; Liu, Guo-Yin, Institute of Space Medico-Engineering, China; Xu, Li-Ming, Institute of Space Medico-Engineering, China; Wang, Bao-Zhen, Institute of Space Medico-Engineering, China; He, Hong, Institute of Space Medico-Engineering, China; Space Medicine and Medical Engineering; December 2002; ISSN 1002-0837; Volume 15, No. 6, pp. 419-422; In Chinese; Copyright; Avail: Issuing Activity

To observe the influences of 21 d head down tilt(HDT) bed rest on the intra-ocular pressure, visual field and near vision in human and to study the countermeasure of Chinese herb against weightlessness. Ten subjects were randomly divided into control group and Chinese herb group. -6 deg HDT was used to simulate weightlessness. Intra-ocular pressure, near vision and vision field were measured before, during and after bed rest in both groups. Intra-ocular pressure and near vision showed a wavelike decrease change during bed rest, and there exists a certain coherence between them. Visual field showed no obvious changes. Taking Chinese herb was able to antagonize the decreasing of intra-ocular pressure and near vision during various phases of bed rest. Bed rest could lead to the decreasing of intra-ocular pressure and near vision; Taking Chinese herb was able to antagonize the negative influences of bed rest on visual function.

Author

*Weightlessness Simulation; Bed Rest; Head Down Tilt; Visual Fields*

**20030018265** Institute of Space Medico-Engineering, Beijing, China

**Effects of Weightlessness on Baroreflex Function**

Shen, Xian-Yun, Institute of Space Medico-Engineering, China; Space Medicine and Medical Engineering; December 2002; ISSN 1002-0837; Volume 15, No. 6, pp. 465-468; In Chinese; Copyright; Avail: Issuing Activity

The declination of baroreceptor reflex function is one of the important factor causing orthostatic intolerance after space flight. The change of baroreceptor reflex function during weightlessness and simulated weightlessness is introduced, and the influence of elevatory upper body blood pressure and electrolyte changes caused by weightlessness on baroreceptor reflex function are analyzed.

Author

*Weightlessness; Baroreflexes; Orthostatic Tolerance*

**20030018410** Xidian Univ., School of Electronic Engineering, Xian, China

**Application of Adaptive Canceling Methods in Temperature Control in Ultrasonic Therapeutical Treatment**

Deng, Jun, Xidian Univ., China; Liu, Du-Ren, Xidian Univ., China; Space Medicine and Medical Engineering; December 2002; ISSN 1002-0837; Volume 15, No. 6, pp. 442-444; In Chinese; Copyright; Avail: Issuing Activity

To improve the quality of ultrasonic therapeutical treatment by improving the accuracy of temperature control. Adaptive canceling methods were used to reduce the noise of temperature signal gained, and enhance signal-to-noise ratio. The test's result corresponds basically to the theoretical curve. Adaptive canceling methods can be applied to clinic treatment.

Author

*Cancellation; Ultrasonic Processing; Signal to Noise Ratios; Heat Treatment; Noise Reduction*

**20030018414** Fourth Military Medical Univ., Dept. of Aerospace Biodynamics, Xi'an, China

**Expression of Heat Shock Protein after +Gz Exposure and Its Protective Effects on +Gz-Induced Brain Injury**

Li, Jin-Sheng, Fourth Military Medical Univ., China; Sun, Xi-Qing, Fourth Military Medical Univ., China; Wu, Xing-Yu, Fourth Military Medical Univ., China; Rao, Zhi-Ren, Fourth Military Medical Univ., China; Liu, Hui-Ling, Fourth Military Medical

Univ., China; Cao, Yi-Zhan, Tangdu Hospital, China; Space Medicine and Medical Engineering; December 2002; ISSN 1002-0837; Volume 15, No. 6, pp. 391-396; In English

Contract(s)/Grant(s): NNSFC-39800158; Copyright; Avail: Issuing Activity

To investigate the rule of intensity and duration of HSP70 expression in rat brain and its relationship with brain injury after repeated + Gz exposures. SD male rats were arranged into control group, + 2 Gz, + 4 Gz, + 6 Gz, and + 10 Gz exposure groups. Rat brains were taken 6 h, 10 h, 1 d, 2 d, 4 d or 6 d after + Gz exposure for histopathologic and immunohistochemic or in situ hybridization studies. The expression of HSP70 and HSP70 mRNA or morphology of neurons were observed. The intensity and duration of HSP70 expression were weak and brief at + 2 Gz exposure, but was relatively extensive. There was a middling reaction of HSP70 only in hippocampal area after + 10 Gz exposure. The duration, extension and intensity of HSP70 expression were wide, long and strong after + 4 Gz and + 6 Gz exposures. After 1 or 3 5 times exposures, the HSP70 expression reached its peak on the first day after + 4 Gz exposures, and dropped obviously on the second day. However the expression of HSP70 maintained a high level after 2 d and was still higher than normal on the 6 d after 3 - 5 times repeated + 4 Gz exposures. The distribution of HSP70 mRNA expression was as same as that of the HSP70 expression but the peak appeared much earlier( 10 h) and its duration was shorter. After + 10 Gz/5 min exposure, degenerated neurons were found in cortex, hippocampus and thalamus regions while the number of degenerated neurons were obviously decreased in such areas in pre-exposure groups with repeated + 4 Gz/3 min for 3 - 5 times. The intensity and duration of HSP70 and HSP70 mRNA expression after + 4 Gz and + 6 Gz exposure were stronger and longer than + 2 Gz and + 10 Gz exposure. The degree of neuron damage after + 10 Gz/5 min exposure in pre-exposure groups with repeated + 4 Gz/3 min 3 - 5 times was obviously slight comparing with that of single + 10 Gz exposure group.

Author

*Brain; Injuries; Rats; Neurons; Damage*

**20030018417** Osaka City Univ., Dept. of Physical Electronics and Informatics, Japan

**Evaluating Skin Condition Using Cosmetics by Image Processing of Cheek Replica**

Hashimoto, Yukie, Osaka City Univ., Japan; Yanagihara, Yoshio, Osaka City Univ., Japan; Hama, Hiromitsu, Osaka City Univ., Japan; Memoirs of the Faculty of Engineering, Osaka City University; December 2002; ISSN 0078-6659; Volume 43, pp. 25-29; In English; Copyright; Avail: Issuing Activity

In this paper, we describe a system for evaluating skin condition about the shape of cheek surface replica by using cosmetics. Various characteristics of skin surface are inspected. The shape of the skin surface provides much information, and then it is very significant to extract features from the skin surface. In this system, we examine the rate of high frequency components from cheek replica images, and we confirm which foundations give fine texture of skin. There are four types of foundations, namely, facial cake, powder and liquid. Extracting the high frequency components, the effect of the system is demonstrated.

Author

*Image Processing; Replicas; Face (Anatomy); Textures; Skin (Anatomy)*

**20030018447** NASA Ames Research Center, Moffett Field, CA USA

**Hormonal Changes During 17 days of Head-Down Bed-Rest**

Custaud, Marc-Antoine, Lyon-1 Univ., France; Arnaud, Sara B., NASA Ames Research Center, USA; Monk, Timothy H., Pittsburgh Univ., USA; Claustrat, Bruno, Hopital Neurologique, France; Gharib, Claude, Lyon-1 Univ., France; Gauquelin-Koch, Guillemette, Lyon-1 Univ., France; Life Sciences; Oct. 01, 2002; ISSN 0024-3205; Volume 9168, pp. 1-14; In English  
Contract(s)/Grant(s): RTOP 106-30-32; RTOP 199-97-62-13; RTOP 199-97-62-16; Copyright; Avail: Issuing Activity

We investigated in six men the impact of 17 days of head-down bed rest (HDBR) on the daily rhythms of the hormones involved in hydroelectrolytic regulation. This HDBR study was designed to mimic a real space flight. Urine samples were collected at each voiding before, during and after HDBR. Urinary excretion of Growth Hormone (GH), Cortisol, 6 Sulfatoxymelatonin, Normetadrenaline (NMN) and Metadrenaline (NM) was determined. A decrease in urinary cortisol excretion during the night of HDBR was noted. For GH, a rhythm was found before and during HDBR. The rhythm of melatonin, evaluated with the urine excretion of 6 Sulfatoxymelatonin (aMT6S), the main hepatic metabolite, persisted throughout the experiment without any modification to the level of phase. A decrease during the night was noted for normetadrenaline urinary derivatives, but only during the HDBR.

Author

*Bed Rest; Circadian Rhythms; Head Down Tilt; Pituitary Hormones; Physiological Responses*

**20030018453** Army Research Inst. of Environmental Medicine, Natick, MA USA

**Cognitive Performance, Mood, and Neurological Status at High Terrestrial Elevation**

Banderet, Louis E.; Shukitt-Hale, Barabar; Jan. 2002; 36p; In English

Report No.(s): AD-A410036; USARIEM-MISC-97-15; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Cognitive and psychomotor performance and mood states, including many critical behavioral functions such as sleep, memory, reasoning, and vigilance, are significantly impaired by ascent to HTE higher than 3,000 m. Impairments in behavior caused by HTE can degrade military operations because the judgment and rate and accuracy of performance of military personnel can be affected. Such adverse effects have distinct and measurable time courses; onset of some effects is immediate (cognitive performance), whereas the onset of others is delayed (symptoms of AMS or adverse moods). The behavioral consequences of HTE are primarily dependent on the level of altitude, the duration of exposure the rate of ascent, an individual's state of physiological acclimation or acclimatization, characteristics of the task performed, and characteristics of the individual such as hypoxic sensitivity. Military history documents that the adverse effects induced by HTE need to be considered when military operations at altitude are planned and undertaken. Current research indicates that some performance decrements induced by ascent to extremely high mountains (e.g., Mount Everest, 8,848 m) may persist for a year or longer after return to lower elevations. Psychological, operational, and medical strategies have been employed to minimize these adverse effects. Psychological strategies often involve training and familiarization with the adverse effects that will be experienced at high altitude.

DTIC

*Cognition; Exposure; High Altitude Environments; Military Operations*

**53**

**BEHAVIORAL SCIENCES**

*Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.*

**20030017887** Zhejiang Univ., Dept. of Psychology and Behavioral Science, China

**Study on Sensitivity of Event-Related EEG Synchronization and Desynchronization Visual Memory Load**

Shen, Mo-Wei, Zhejiang Univ., China; Yi, Yu-Ji, Zhejiang Univ., China; Xu, Qing, Zhejiang Univ., China; Space Medicine and Medical Engineering; December 2002; ISSN 1002-0837; Volume 15, No. 6, pp. 445-447; In Chinese; Copyright; Avail: Issuing Activity

To examine the effect of visual working memory load on the event-related EEG synchronization and desynchronization. EEG was recorded when 12 normal participants were performing the visual spatial matching task and the abstract geometrical figure matching task in the n-back paradigm in which the memory load varied from 1 to 3. Theta ERS was observed along with alpha ERD. As the memory load increased, the 6 - 8 Hz ERS decreased and the alpha ERD increased. The theta ERS and alpha ERD elicited by the figure matching task were larger than those in the visual spatial matching task. The fact that most of the differences were observed in the CZ and FZ electrodes was in line with the view that the activation of attention and working memory was often found in prefrontal and parietal regions. The event-related EEG synchronization and desynchronization varies with the visual memory load and therefore are good indicators of memory load.

Author

*Synchronism; Electroencephalography; Loads (Forces); Visual Perception*

**54**

**MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT**

*Includes human factors engineering; bionics, man-machine, life support, space suits and protective clothing. For related information see also 16 Space Transportation and 52 Aerospace Medicine..*

**20030015821** Rehabilitation Inst. of Chicago, Chicago, IL USA

**Effect of Robot-Assisted and Unassisted Exercise on Functional Reaching in Chronic Hemiparesis**

Kahn, L. E.; Zygman, M. L.; Rymer, W. Z.; Reinkensmeyer, D. J.; Oct. 25, 2001; 5p; In English; Papers from the 23rd Annual International Conference of the IEEE engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on cd-rom.,

Contract(s)/Grant(s): H133G80052

Report No.(s): AD-A409470; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

A common therapeutic approach for the rehabilitation of patients with hemiparesis ' involves repetitive voluntary,' movements with manual assistance from a therapist ('active-assist therapy'). We used a novel robotic device to deliver a controlled form of active-assist therapy in chronic stroke patients (N 7). to examine the utility of direct mechanical assistance in rehabilitation of voluntary arm movements, a matched group of subjects with chronic hemiparesis (N 7) performed the same repetitive exercises without the aid of the robotic device, Each group performed 24 therapy sessions over 8 weeks, We found that both groups demonstrated significant improvements in straightness of voluntary reaching movements, with limited improvements in range. Only the group that received robotic therapy significantly improved the smoothness of reaching. Improvements in both groups transferred to an unpracticed reaching movement and the timed performance of functional tasks. There were no significant differences in the magnitude of improvements between the two groups. These results suggest that it is the action of repetitively attempting to move, rather than the mechanical assistance provided by the robot, that stimulates arm movement recovery. However, imposing a smooth trajectory,' during practice of the reaching movements may help subjects learn how to produce smoother movements. In addition, practicing robot-assisted or unassisted reaching movements apparently improves control processes that generalize to other functional movements.

DTIC

*Mechanical Properties; Robotics; Manual Control*

**20030015849** National Inst. for Longevity Sciences, Aichi, Japan

**Evaluation of Walkers for Elderly People**

Tamura, T.; Sekine, M.; Kuno, H.; Fujie, M.; Mori, A.; Oct. 25, 2001; 3p; In English; Original contains color illustrations; Papers from the 23rd Annual International Conference of the IEEE engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on CD-ROM

Report No.(s): AD-A409536; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The aim of this study was to evaluate three types of walkers for elderly people. Four elderly patients participated in the study. The experiments were performed using three walkers: a familiar conventional folding walker, a caster walker and a power-assisted walker. We evaluated walking speed, body acceleration and an electromyogram of the gastrocnemius during use of each walker. The results indicated that walkers should be selected according to the patient's walking ability. Comparisons between power-assisted walker and parallel bar, the walking speed in power-assisted walker is higher than that in the parallel bar. Power-assisted walkers are suitable for patients who are used to using a wheelchair.

DTIC

*Age Factor; Electromyography; Walking; Medical Equipment*

**20030015859** Universidade Estadual de Campinas, Brazil

**Proposal of Modeling, Simulation and Implementation of Robotics Leg Prosthesis**

Hermi, Helder A.; Rosario, Joao M.; Cassemiro, Edna R.; Oct. 25, 2001; 5p; In English; Papers from the 23rd Annual International Conference of the IEEE engineering in Medicine and Biology Society, October 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on CD-ROM

Report No.(s): AD-A409551; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

This paper presents a proposal of modeling, simulation and implementation of a robotic biped locomotion system. The initial step is consisted of the determination of kinematic characteristics and the system performance during walking. Starting from the methodology of the generated kinematics model, several computational programs were elaborated with the purpose of reproducing and managing the space displacement, velocity and acceleration of the articulate system. to validate the developed algorithm, was elaborated an articulate system prototype of robotic leg in which will be implemented and tested with the developed methodology.

DTIC

*Robotics; Simulation; Prosthetic Devices; Mathematical Models; Leg (Anatomy)*

**20030017886** Sichuan Univ., Biomechanics Research Lab., Chengdu, China

**Study on Mechanical Factors Involved in Sports Muscle Injury**

Tian, Jia, Sichuan Univ., China; Fan, Yu-Bo, Sichuan Univ., China; Sun, Xiao-Min, Sichuan Univ., China; Chu, Yun, Sichuan Univ., China; Sun, Zhong-Qiu, Sichuan Univ., China; Space Medicine and Medical Engineering; December 2002; ISSN 1002-0837; Volume 15, No. 6, pp. 450-452; In Chinese; Copyright; Avail: Issuing Activity

The objective of this research was to investigate the effect of eccentric strengthening (EC) exercise on muscular structure, plasma CK and biomechanical behavior under different mechanical loadings and to study the mechanical factors involved in sports muscle injury. We developed an apparatus to do eccentric strength training with male SD rats under different mechanical

loadings and to measure the biomechanical behavior. No significant difference (P greater than 0.05) of muscular structure, plasma CK and biomechanical behavior were found between high and low force groups. Skeletal muscle injury after cyclic EC with different mechanical loadings suggested that muscle damage is not simply a function of peak muscle force.

Author

*Rats; Muscles; Physical Exercise; Injuries; Biodynamics*

**20030017888** Institute of Space Medico-Engineering, Beijing, China

**A Study for Time-History Waveform Synthesis of Algorithm in Shock Response Spectrum (SRS)**

Liu, Hong-Ying, Institute of Space Medico-Engineering, China; Ma, Ai-Jun, Institute of Space Medico-Engineering, China; Space Medicine and Medical Engineering; December 2002; ISSN 1002-0837; Volume 15, No. 6, pp. 437-441; In Chinese; Copyright; Avail: Issuing Activity

To present an effective on-line SRS time-history waveform synthesis method for simulating pyrotechnic shock environment with electrodynamic shakers. A procedure was developed for synthesizing a SRS time-history waveform according to a general principle. The effect of three main parameters to waveform's shape, amplitude of acceleration and duration were investigated. A modification method of SRS's amplitude and an optimal algorithm of time-history waveform were presented. The algorithm was used to generate a time-history waveform that could satisfy SRS's accuracy requirement and electrodynamic shaker's acceleration limitation. The numerical example indicates that the developed method is effective. The synthesized time-history waveform can be used to simulate pyrotechnic shock environment using electrodynamic shakers.

Author

*Waveforms; Time Functions; Computerized Simulation; Shakers; Shock Spectra*

**20030017890** Beijing Univ. of Aeronautics and Astronautics, Dept. of Flight Vehicle Design and Applied Mechanics, Beijing, China

**Analysis of Human Two-Dimension Target-Aiming Movement**

Liu, Wei, Beijing Univ. of Aeronautics and Astronautics, China; Yuan, Xiu-Gan, Beijing Univ. of Aeronautics and Astronautics, China; Liu, Zhong-Qi, Beijing Univ. of Aeronautics and Astronautics, China; Wang, Rui, Beijing Univ. of Aeronautics and Astronautics, China; Kang, Wei-Yong, Beijing Univ. of Aeronautics and Astronautics, China; Space Medicine and Medical Engineering; December 2002; ISSN 1002-0837; Volume 15, No. 6, pp. 397-401; In English; Sponsored in part by Chinese Doctor Research Fund

Contract(s)/Grant(s): 1999000619; 59099; Copyright; Avail: Issuing Activity

To study the problem of human movement characteristics of target-aiming movement. The authors first analyzed the essentials of target-aiming movement on the basis of previous research results, then designed and made a two-dimension experiment of target-aiming movement. After theoretical consideration and analysis of experimental results, a new model of human two-dimension target-aiming movement was proposed, and the coefficients are determined experimentally. The model was verified by experimental data. It was demonstrated that the new model has an excellent suitability, and is applicable for evaluations of target-aiming movements of one and two dimensions.

Author

*Human Factors Engineering; Man Machine Systems; Systems Analysis; Mathematical Models; Motion*

**20030017891** Beijing Univ. of Aeronautics and Astronautics, Dept. of Flight Vehicle Design and Applied Mechanics, Beijing, China

**A Dynamic Model of the Extravehicular Activity Space Suit**

Yang, Feng, Beijing Univ. of Aeronautics and Astronautics, China; Yuan, Xiu-Gan, Beijing Univ. of Aeronautics and Astronautics, China; Space Medicine and Medical Engineering; December 2002; ISSN 1002-0837; Volume 15, No. 6, pp. 453-454; In Chinese; Copyright; Avail: Issuing Activity

The objective of this research was to establish a dynamic model of the space suit base on the particular configuration of the space suit. The mass of the space suit components, moment of inertia, mobility of the joints of space suit, as well as the suit-generated torques, were considered in this model. The expressions to calculate the moment of inertia were developed by simplifying the geometry of the space suit. A modified Preisach model was used to mathematically describe the hysteretic torque characteristics of joints in a pressurized space suit, and it was implemented numerically basing on the observed suit parameters. A dynamic model considering mass, moment of inertia and suit-generated torques was established. This dynamic model provides some elements for the dynamic simulation of the astronaut extravehicular activity.

Author

*Dynamic Models; Extravehicular Activity; Space Suits*

20030018266 Institute of Space Medico-Engineering, Beijing, China

**Review of Influence of Landing Impact on Human Body and Its Medical Evaluation**

Guo, Yao-Yu, Institute of Space Medico-Engineering, China; Tan, Cheng, Institute of Space Medico-Engineering, China; Liu, Bing-Kun, Institute of Space Medico-Engineering, China; Jiang, Shi-Zhong, Institute of Space Medico-Engineering, China; Space Medicine and Medical Engineering; December 2002; ISSN 1002-0837; Volume 15, No. 6, pp. 455-459; In Chinese; Copyright; Avail: Issuing Activity

Landing impact is the dynamic factor that manned spaceship will inevitably meet after the mission has been completed, and impact force may cause damages to human tissues and organs, even death. This paper described the characteristics of pathological and dynamic response of human body to landing impact, and discussed various related factors such as impact angle, fetters, design of cushion, harness and terrain condition. Medical evaluation of + G(sub x), + G(sub z), +/- G(sub y) impacts were summarized.

Author

*Human Body; Acceleration Tolerance; Physiological Responses; Landing Loads; Spacecraft Landing; Dynamic Response*

20030018412 Institute of Space Medico-Engineering, Beijing, China

**Overall Design and Proof-Test of an Integrated Environmental Control and Life Support System (ECLSS) for Demonstration and Verification**

Rui, Jia-Bai, Institute of Space Medico-Engineering, China; Zheng, Chuan-Xian, Institute of Space Medico-Engineering, China; Zeng, Qing-Tang, Institute of Space Medico-Engineering, China; Space Medicine and Medical Engineering; December 2002; ISSN 1002-0837; Volume 15, No. 6, pp. 423-427; In Chinese; Copyright; Avail: Issuing Activity

To test and demonstrate embryonic form of our future space station ECLSS, which will also form an advanced research and test ground facility. The following functions of the system were tested and demonstrated: integrated solid amine CO<sub>2</sub> collection and concentration, Sabatier CO<sub>2</sub> reduction, urine processing thermoelectric integrated membrane evaporation, solid polymer water electrolysis O<sub>2</sub> generation, concentrated ventilation, temperature and humidity control, the measurement and control system, and other non-regenerative techniques. All of these were demonstrated in a sealed adiabatic module, and passed the proof-tests. The principal technical requirements of the system and each regenerative subsystem were met. The integration of system general and each subsystem was successful, and the partial closed loop of the system's integration has been realized basically. The reasonableness of the project design was verified, and the major system technical requirements were satisfied. The suitability and harmonization among system general and each subsystem were good, the system operated normally, and the parameters measured were correct.

Author

*Space Stations; Life Support Systems; Environmental Control; Systems Integration; Design Analysis; Spacecraft Equipment*

20030018413 Institute of Space Medico-Engineering, Beijing, China

**Study on Anti +Gz Respiratory Maneuver and Its Training Method**

Xue, Yue-Ying, Institute of Space Medico-Engineering, China; You, Guang-Xing, Institute of Space Medico-Engineering, China; Wu, Bin, Institute of Space Medico-Engineering, China; Liu, Xing-Hua, Institute of Space Medico-Engineering, China; Lu, Sheng-Qiang, Institute of Space Medico-Engineering, China; Xie, Bao-Sheng, Institute of Space Medico-Engineering, China; Space Medicine and Medical Engineering; December 2002; ISSN 1002-0837; Volume 15, No. 6, pp. 399-405; In Chinese; Copyright; Avail: Issuing Activity

To study the anti + G<sub>x</sub> respiratory maneuver and its training method. Seven young male subjects undertook the anti + G<sub>x</sub> respiratory maneuver training. Their + G<sub>x</sub> tolerances were examined on human centrifuge before and after training. The change of respiratory type, breath rate, electrocardiogram, heart rate, arterial oxygen saturation (SaO<sub>2</sub>), subjective symptom and vision were real-time monitored during the + G<sub>x</sub> tolerance examination. Result Compared with pre-training, the + G<sub>x</sub> tolerance increased after training (P less than 0.05). Dyspnea and chest pain disappeared or obviously lightened and the magnitude of decrease of SaO<sub>2</sub> decreased significantly (P less than 0.05). The above results suggested that the anti + G<sub>x</sub> respiratory maneuver can effectively eliminate or alleviate dyspnea and chest pain induced by + G<sub>x</sub> stress and increase human + G<sub>x</sub> tolerance.

Author

*Education; Health; Stress (Physiology); Reduction*

**COMPUTER OPERATIONS AND HARDWARE**

*Includes hardware for computer graphics, firmware and data processing. For components see 33 Electronics and Electrical Engineering. For computer vision see 63 Cybernetics, Artificial Intelligence and Robotics.*

**20030016690** Defence Science and Technology Organisation, Information Sciences Lab., Edinburgh, Australia

**Applying the FINC (Force, Intelligence, Networking and C2) Methodology to the Land Environment**

Dekker, Anthony H., Defence Science and Technology Organisation, Australia; October 2002; 53p; In English; Original contains color illustrations

Report No.(s): DSTO-GD-0341; DODA-AR-012-471; Copyright; Avail: Issuing Activity

In this paper we re-examine the FINC (Force, Intelligence, Networking and C2) methodology for analysing C4ISR architectures, studying its applicability to hierarchical organizational structures in the Land environment. For this study we utilize a search-and-manoevre experimental scenario, implemented using an agent-based simulation written in Java. The FINC methodology allows the calculation of three metrics or coefficients for every C4ISR architecture: the information flow coefficient, the coordination coefficient, and the intelligence coefficient. Our experiment shows that the FINC intelligence coefficient alone was able to predict 95% of the variance in performance. Consequently, the intelligence coefficient can be used to compare C4ISR architectures, and predict with moderate accuracy which one will give the best performance. A brief study of some US Civil War battles confirms the usefulness of the intelligence coefficient.

Author

*Land Management; Artificial Intelligence; Information Flow; Methodology; Computer Networks; Mathematical Models; Architecture (Computers)*

**COMPUTER PROGRAMMING AND SOFTWARE**

*Includes software engineering, computer programs, routines, algorithms, and specific applications, e.g., CAD/CAM. For computer software applied to specific applications, see also the associated category.*

**20030014734** NASA Langley Research Center, Hampton, VA USA

**Computation of Engine Noise Propagation and Scattering Off an Aircraft**

Xu, J., Florida State Univ., USA; Stanescu, D., Florida State Univ., USA; Hussaini, M. Y., Florida State Univ., USA; Farassat, F., NASA Langley Research Center, USA; [2003]; 11p; In English; 41st Aerospace Sciences Meeting and Exhibit, 6-9 Jan. 2003, Reno, NV, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA; Original contains color illustrations

Contract(s)/Grant(s): NAG1-01031

Report No.(s): AIAA Paper 2003-0542; Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche; Distribution as joint owner in the copyright under grant number NAG1-01031; Distribution as joint owner in the copyright under grant number NAG1-01031

The paper presents a comparison of experimental noise data measured in flight on a two-engine business jet aircraft with Kulite microphones placed on the suction surface of the wing with computational results. Both a time-domain discontinuous Galerkin spectral method and a frequency-domain spectral element method are used to simulate the radiation of the dominant spinning mode from the engine and its reflection and scattering by the fuselage and the wing. Both methods are implemented in computer codes that use the distributed memory model to make use of large parallel architectures. The results show that trends of the noise field are well predicted by both methods.

Author

*Noise Propagation; Engine Noise; Wave Scattering; Jet Aircraft Noise; Applications Programs (Computers); Noise Prediction (Aircraft); Mathematical Models*

**20030014746** Kestrel Technology, LLC, Palo Alto, CA USA

**A Rewriting-Based Approach to Trace Analysis**

Havelund, Klaus, Kestrel Technology, LLC, USA; Rosu, Grigore, Illinois Univ. at Urbana-Champaign, USA; [2002]; 20p; In English

Contract(s)/Grant(s): NAS2-00065; Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche; Distribution as joint owner in the copyright; Distribution as joint owner in the copyright

We present a rewriting-based algorithm for efficiently evaluating future time Linear Temporal Logic (LTL) formulae on finite execution traces online. While the standard models of LTL are infinite traces, finite traces appear naturally when testing and/or

monitoring red applications that only run for limited time periods. The presented algorithm is implemented in the Maude executable specification language and essentially consists of a set of equations establishing an executable semantics of LTL using a simple formula transforming approach. The algorithm is further improved to build automata on-the-fly from formulae, using memoization. The result is a very efficient and small Maude program that can be used to monitor program executions. We furthermore present an alternative algorithm for synthesizing probably minimal observer finite state machines (or automata) from LTL formulae, which can be used to analyze execution traces without the need for a rewriting system, and can hence be used by observers written in conventional programming languages. The presented work is part of an ambitious runtime verification and monitoring project at NASA Ames, called PATHEXPLORER, and demonstrates that rewriting can be a tractable and attractive means for experimenting and implementing program monitoring logics.

Author

*Algorithms; Temporal Logic; Programming Languages; Linear Systems; Optimization*

**20030014803** Lockheed Martin Corp., Houston, TX USA

**Effects on Training Using Illumination in Virtual Environments**

Maida, James C., Lockheed Martin Corp., USA; Novak, M. S. Jennifer, Lockheed Martin Corp., USA; Mueller, Kristian, Lockheed Martin Corp., USA; [1999]; 6p; In English; HCI International 1999, 22-27 Aug. 1999, Munich, Germany  
Contract(s)/Grant(s): NRA-95-OLSMA-01; Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche; Distribution as joint owner in the copyright; Distribution as joint owner in the copyright

Camera based tasks are commonly performed during orbital operations, and orbital lighting conditions, such as high contrast shadowing and glare, are a factor in performance. Computer based training using virtual environments is a common tool used to make and keep CTW members proficient. If computer based training included some of these harsh lighting conditions, would the crew increase their proficiency? The project goal was to determine whether computer based training increases proficiency if one trains for a camera based task using computer generated virtual environments with enhanced lighting conditions such as shadows and glare rather than color shaded computer images normally used in simulators. Previous experiments were conducted using a two degree of freedom docking system. Test subjects had to align a boresight camera using a hand controller with one axis of rotation and one axis of rotation. Two sets of subjects were trained on two computer simulations using computer generated virtual environments, one with lighting, and one without. Results revealed that when subjects were constrained by time and accuracy, those who trained with simulated lighting conditions performed significantly better than those who did not. To reinforce these results for speed and accuracy, the task complexity was increased.

Derived from text

*Computerized Simulation; Education; Virtual Reality; Illumination*

**20030014825** NASA Ames Research Center, Moffett Field, CA USA

**Load Balancing Strategies for Multi-Block Overset Grid Applications**

Djomehri, M. Jahed, Computer Sciences Corp., USA; Biswas, Rupak, NASA Ames Research Center, USA; Lopez-Benitez, Noe, Texas Technological Univ., USA; Oct. 01, 2002; 16p; In English; ISCA 18th International Conference on Computers and Their Applications, 26-28 Mar. 2003, Honolulu, HI, USA; Sponsored by International Society for Computers and Their Applications, Unknown

Contract(s)/Grant(s): NASA Order A-61812-D; DTTS59-99-D-00437; Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche; Distribution as joint owner in the copyright; Distribution as joint owner in the copyright

The multi-block overset grid method is a powerful technique for high-fidelity computational fluid dynamics (CFD) simulations about complex aerospace configurations. The solution process uses a grid system that discretizes the problem domain by using separately generated but overlapping structured grids that periodically update and exchange boundary information through interpolation. For efficient high performance computations of large-scale realistic applications using this methodology, the individual grids must be properly partitioned among the parallel processors. Overall performance, therefore, largely depends on the quality of load balancing. In this paper, we present three different load balancing strategies for overset grids and analyze their effects on the parallel efficiency of a Navier-Stokes CFD application running on an SGI Origin2000 machine.

Author

*Computational Fluid Dynamics; Computational Grids; Loads (Forces); Multiblock Grids; Navier-Stokes Equation*

**20030014953** Computer Sciences Corp., Moffett Field, CA USA

**Performance of OVERFLOW-D Applications based on Hybrid and MPI Paradigms on IBM Power4 System**

Djomehri, M. Jahed, Computer Sciences Corp., USA; [2002]; 6p; In English

Contract(s)/Grant(s): NASA Order A-61812-D; DTTS59-99-D-00437; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

This report briefly discusses our preliminary performance experiments with parallel versions of OVERFLOW-D applications. These applications are based on MPI and hybrid paradigms on the IBM Power4 system here at the NAS Division. This work is part of an effort to determine the suitability of the system and its parallel libraries (MPI/OpenMP) for specific scientific computing objectives.

Author

*Multiprocessing (Computers); Supercomputers; Architecture (Computers); Applications Programs (Computers); Performance Tests; Computer Systems Performance*

**20030015196** NASA Ames Research Center, Moffett Field, CA USA

**Three-Dimensional High-Order Spectral Finite Volume Method for Unstructured Grids**

Liu, Yen, NASA Ames Research Center, USA; Vinokur, Marcel, NASA Ames Research Center, USA; Wang, Z. J., Michigan State Univ., USA; Nov. 15, 2002; 12p; In English; 16th AIAA CFD Conference, 23-26 Jun. 2003, Orlando, FL, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA; Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche; Distribution as joint owner in the copyright; Distribution as joint owner in the copyright

Many areas require a very high-order accurate numerical solution of conservation laws for complex shapes. This paper deals with the extension to three dimensions of the Spectral Finite Volume (SV) method for unstructured grids, which was developed to solve such problems. We first summarize the limitations of traditional methods such as finite-difference, and finite-volume for both structured and unstructured grids. We then describe the basic formulation of the spectral finite volume method. What distinguishes the SV method from conventional high-order finite-volume methods for unstructured triangular or tetrahedral grids is the data reconstruction. Instead of using a large stencil of neighboring cells to perform a high-order reconstruction, the stencil is constructed by partitioning each grid cell, called a spectral volume (SV), into 'structured' sub-cells, called control volumes (CVs). One can show that if all the SV cells are partitioned into polygonal or polyhedral CV sub-cells in a geometrically similar manner, the reconstructions for all the SVs become universal, irrespective of their shapes, sizes, orientations, or locations. It follows that the reconstruction is reduced to a weighted sum of unknowns involving just a few simple adds and multiplies, and those weights are universal and can be pre-determined once for all. The method is thus very efficient, accurate, and yet geometrically flexible. The most critical part of the SV method is the partitioning of the SV into CVs. In this paper we present the partitioning of a tetrahedral SV into polyhedral CVs with one free parameter for polynomial reconstructions up to degree of precision five. (Note that the order of accuracy of the method is one order higher than the reconstruction degree of precision.) The free parameter will be determined by minimizing the Lebesgue constant of the reconstruction matrix or similar criteria to obtain optimized partitions. The details of an efficient, parallelizable code to solve three-dimensional problems for any order of accuracy are then presented. Important aspects of the data structure are discussed. Comparisons with the Discontinuous Galerkin (DG) method are made. Numerical examples for wave propagation problems are presented.

Author

*Finite Volume Method; Unstructured Grids (Mathematics); Three Dimensional Models; Structured Grids (Mathematics); Grid Generation (Mathematics); Shapes; Data Structures*

**20030015197** Alabama Univ., Dept. of Engineering, Huntsville, AL USA

**An Analysis of Computer Aided Design (CAD) Packages Used at MSFC for the Recent Initiative to Integrate Engineering Activities**

Smith, Leigh M., Alabama Univ., USA; Fall 2002; 26p; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper analyzes the use of Computer Aided Design (CAD) packages at NASA's Marshall Space Flight Center (MSFC). It examines the effectiveness of recent efforts to standardize CAD practices across MSFC engineering activities. An assessment of the roles played by management, designers, analysts, and manufacturers in this initiative will be explored. Finally, solutions are presented for better integration of CAD across MSFC in the future.

Author

*Computer Aided Design; Computer Programs; Engineering Management*

**20030015242** Eidgenoessische Technische Hochschule, Computer Systems Inst., Zurich, Switzerland

**High-Level Data Races**

Artho, Cyrille, Eidgenoessische Technische Hochschule, Switzerland; Havelund, Klaus, Kestrel Technology, LLC, USA; Biere, Armin, Eidgenoessische Technische Hochschule, Switzerland; [2003]; 8p; In English; VVEIS 2002, 22 Apr. 2003, Angers, France

Contract(s)/Grant(s): NAS2-00065; Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche; Distribution as joint owner in the copyright; Distribution as joint owner in the copyright

Data races are a common problem in concurrent and multi-threaded programming. They are hard to detect without proper tool support. Despite the successful application of these tools, experience shows that the notion of data race is not powerful enough to capture certain types of inconsistencies occurring in practice. In this paper we investigate data races on a higher abstraction layer. This enables us to detect inconsistent uses of shared variables, even if no classical race condition occurs. For example, a data structure representing a coordinate pair may have to be treated atomically. By lifting the meaning of a data race to a higher level, such problems can now be covered. The paper defines the concepts view and view consistency to give a notation for this novel kind of property. It describes what kinds of errors can be detected with this new definition, and where its limitations are. It also gives a formal guideline for using data structures in a multi-threading environment.

Author

*Data Structures; Structured Programming; Concurrent Processing; Architecture (Computers); Error Analysis; Variable; Algorithms*

**20030015249** NASA Langley Research Center, Hampton, VA USA

**Flight Dynamic Model Exchange using XML**

Jackson, E. Bruce, NASA Langley Research Center, USA; Hildreth, Bruce L., Science Applications International Corp., USA; [2002]; 10p; In English; Modeling and Simulation Conference, 5-8 Aug. 2002, Monterey, CA, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Report No.(s): AIAA Paper 2002-4482; Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche; Distribution as joint owner in the copyright; Distribution as joint owner in the copyright

The AIAA Modeling and Simulation Technical Committee has worked for several years to develop a standard by which the information needed to develop physics-based models of aircraft can be specified. The purpose of this standard is to provide a well-defined set of information, definitions, data tables and axis systems so that cooperating organizations can transfer a model from one simulation facility to another with maximum efficiency. This paper proposes using an application of the eXtensible Markup Language (XML) to implement the AIAA simulation standard. The motivation and justification for using a standard such as XML is discussed. Necessary data elements to be supported are outlined. An example of an aerodynamic model as an XML file is given. This example includes definition of independent and dependent variables for function tables, definition of key variables used to define the model, and axis systems used. The final steps necessary for implementation of the standard are presented. Software to take an XML-defined model and import/export it to/from a given simulation facility is discussed, but not demonstrated. That would be the next step in final implementation of standards for physics-based aircraft dynamic models.

Author

*Aerodynamic Characteristics; Aircraft Models; Dynamic Models*

**20030015254** Mississippi Univ., University, MS USA

**Automatic Web Searching and Categorizing Using Query Expansion and Focusing *Final Report, 1 Jul. 2001-30 Sep. 2002***

Conlon, Sumali; Jan. 10, 2003; 6p; In English

Contract(s)/Grant(s): N00014-01-1-0917

Report No.(s): AD-A409512; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

We are in the process of build a prototype system that improves precision and recall rates for web search using query expansion and focusing techniques. We use linguistic analysis and co-occurrence information to analyze syntactic structures of the users' queries to improve search results. One standard method of improving internet search is through query expansion. The major query expansion techniques add terms using (i) lexical semantic relations and (ii) relevance feed back. The lexical semantic relations in WordNet have been used widely as a main lexical resource for approach (i). Past research results indicate that using WordNet did not significantly improve information retrieval effectiveness. Our query expansion system also uses WordNet in a query expansion stage. However, instead of just adding all related terms from WordNet (synonyms, hypernyms, hyponyms, etc.) directly into user's queries, our system selects only useful additional terms. This selection process uses syntactic analysis combined with collocation and co-occurrence information from a large corpus collected from our domain of interest (IT).

DTIC

*Information Retrieval; Data Structures; Focusing; Internets*

**20030015444** Air Force Inst. of Tech., School of Engineering and Management, Wright-Patterson AFB, OH USA

**Visual Execution Analysis for Multiagent Systems**

Kil, Chong Kyung; Aug. 2002; 91p; In English; Original contains color images

Report No.(s): AD-A409406; AFIT/GCS/ENG/02-12; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

Multiagent systems have become increasingly important in developing complex software systems. Multiagent systems introduce collective intelligence and provide benefits such as flexibility, scalability, decentralization, and increased reliability. A software agent is a high-level software abstraction that is capable of performing given tasks in an environment without human intervention. Although multiagent systems provide a convenient and powerful way to organize complex software systems, developing such system is very complicated. To help manage this complexity this research develops a methodology and technique for analyzing, monitoring and troubleshooting multiagent systems execution. This is accomplished by visualizing a multiagent system at multiple levels of abstraction to capture the relationships and dependencies among the agents.

DTIC

*Systems Engineering; Software Development Tools*

**20030015489** NASA Langley Research Center, Hampton, VA USA

**Bi-Level Integrated System Synthesis (BLISS) for Concurrent and Distributed Processing**

Sobieszczanski-Sobieski, Jaroslaw, NASA Langley Research Center, USA; Altus, Troy D., George Washington Univ., USA; Phillips, Matthew, George Washington Univ., USA; Sandusky, Robert, George Washington Univ., USA; [2002]; 16p; In English; 9th AIAA/NASA/USAF/ISSMO Symposium on Multidisciplinary Analysis and Optimization, 4-6 Sep. 2002, Atlanta, GA, USA; Sponsored by NASA, USA

Report No.(s): AIAA Paper 2002-5409; Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche; Distribution as joint owner in the copyright; Distribution as joint owner in the copyright

The paper introduces a new version of the Bi-Level Integrated System Synthesis (BLISS) methods intended for optimization of engineering systems conducted by distributed specialty groups working concurrently and using a multiprocessor computing environment. The method decomposes the overall optimization task into subtasks associated with disciplines or subsystems where the local design variables are numerous and a single, system-level optimization whose design variables are relatively few. The subtasks are fully autonomous as to their inner operations and decision making. Their purpose is to eliminate the local design variables and generate a wide spectrum of feasible designs whose behavior is represented by Response Surfaces to be accessed by a system-level optimization. It is shown that, if the problem is convex, the solution of the decomposed problem is the same as that obtained without decomposition. A simplified example of an aircraft design shows the method working as intended. The paper includes a discussion of the method merits and demerits and recommendations for further research.

Author

*Aircraft Design; Design Analysis; Distributed Processing; Multiprocessing (Computers)*

**20030015725** NASA Ames Research Center, Moffett Field, CA USA

**Comparing a Coevolutionary Genetic Algorithm for Multiobjective Optimization**

Lohn, Jason D., NASA Ames Research Center, USA; Kraus, William F., QSS Group, Inc., USA; Haith, Gary L., Narex Corp., USA; [2002]; 6p; In English; IEEE Congress on Evolutionary Computation, 2002, Unknown; Sponsored by Institute of Electrical and Electronics Engineers, USA; Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche; Distribution as joint owner in the copyright; Distribution as joint owner in the copyright

We present results from a study comparing a recently developed coevolutionary genetic algorithm (CGA) against a set of evolutionary algorithms using a suite of multiobjective optimization benchmarks. The CGA embodies competitive coevolution and employs a simple, straightforward target population representation and fitness calculation based on developmental theory of learning. Because of these properties, setting up the additional population is trivial making implementation no more difficult than using a standard GA. Empirical results using a suite of two-objective test functions indicate that this CGA performs well at finding solutions on convex, nonconvex, discrete, and deceptive Pareto-optimal fronts, while giving respectable results on a nonuniform optimization. On a multimodal Pareto front, the CGA finds a solution that dominates solutions produced by eight other algorithms, yet the CGA has poor coverage across the Pareto front.

Author

*Genetic Algorithms; Targets; Optimization*

**20030015786** California State Polytechnic Univ., Pomona, CA USA

**Visualization and Animation in Civil Engineering Final Report, 15 Sep. 2001-14 Sep 2002**

Turner, Howard; Neto, Francelina A.; Hohmann, Edward; Dec. 12, 2002; 39p; In English

Contract(s)/Grant(s): F49620-01-1-0539

Report No.(s): AD-A409376; AFRL-SR-AR-TR-02-0437; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Building 17, Room 1671 at California State Polytechnic University Pomona, an 1800 sq ft. laboratory, houses the 25 Dell 530 workstations acquired. Each computer is equipped with a stereographic emitter, a trackball and a Wildcat 5110 video card to perform softcopy photogrammetry, stereo visualization, and animation. The civil engineering curriculum has been modified to include visualization and animation concepts into lower and upper division courses. Rhino-3D, a simple 3d modeling tool, was added to the freshman CAD class. The resources leveraged from this grant, more than \$7 million, allowed the curriculum to be modified. A new course CE 420 Digital Mapping was added to the curriculum This new course focuses on 3D data collection, modeling, visualization and animation. In the one year performance period, approximately 120 freshman and 50 senior students from under represented groups have been exposed to visualization and animation concepts. The total number of students exposed to these concepts is approximately 270. As the project develops and grows, it is anticipated that more than one thousand students will be exposed, through course expansion, faculty workshops, and high school visits in this state-of-the-art laboratory. state-of-the-art laboratory.

DTIC

*Computer Graphics; Animation; Education*

**20030015788** Department of Defense, Office of the Inspector General, Arlington, VA USA

**Information Technology: Development Testing of Prophet Mission-Critical Software**

Brinkman, David A.; Stavenjord, Kenneth H.; Johnson, Peter C.; Tran, Anh H.; Gladden, Cindy L.; Jan. 22, 2003; 31p; In English  
Report No.(s): AD-A409379; D-2003-051; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report is a review of the development testing of mission-critical software for the U.S. Army Prophet Engineering and Manufacturing Development (EMD) System and the Prophet Block I System. Prophet is a Division-Level ground based electronic surveillance system, which provides protection in a direct support role to the maneuver brigade; either stationary, or while on the move. The system monitors and exploits signals of interest and determines the area of signal origin by providing direction finding and line-of-bearing in the frequency range of 20 Megahertz to 2000 Megahertz. Prophet is operated in either the dismounted or mounted mode. In the dismounted mode Prophet is man-packed with a portable antenna. In the mounted mode Prophet is installed in an equipment enclosure carried on a High Mobility Multi-Purpose Wheeled Vehicle with the antennas attached to a retractable mast.

DTIC

*Program Verification (Computers); Human-Computer Interface; Signal Processing; Computers*

**20030015793** United Technologies Research Center, East Hartford, CT USA

**Study of Commercial Off-the-Shelf (COTS) Real-Time Operating Systems (RTOS) in Aviation Applications Final Report, May 2001-May 2002**

Halwan, Vivek; Krodel, Jim; Dec. 2002; 42p; In English

Contract(s)/Grant(s): DTFA03-01-P-10129

Report No.(s): AD-A409387; DOT/FAA/AR-02/118; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Commercially available real-time operating systems (RTOS) are seen as candidates for use in airborne-embedded software systems by airframe and engine manufacturers, because of the perceived cost and time savings associated with using commercial off-the-shelf (COTS) components. Software professionals have pursued the reuse model established in the hardware arena for using COTS hardware components when building a system. Hardware designs can be fabricated from subassemblies and other components. Software designers have not been as effective in establishing their own reuse for COTS software components. Nevertheless, software component reuse is still sought as a means for increasing software development productivity and reducing development costs and schedule times. This report takes a detailed look into the safety and certification issues of using a COTS RTOS in aviation applications. RTOS attributes are detailed and their safety-related properties are discussed along with considerations to address when integrating a COTS RTOS with an application in an aviation system.

DTIC

*Software Engineering; Commercial Off-The-Shelf Products; Real Time Operation; Operating Systems (Computers)*

**20030015795** Carnegie-Mellon Inst. of Research, Pittsburgh, PA USA

**The Carnegie Mellon University Insert Project Final Report, 1 Oct. 1996-28 Feb. 1997**

Lehoczky, John; Sha, Lui; Krogh, Bruce; Feiler, Peter; Rajkumar, Rangunathan; Feb. 1997; 18p; In English

Contract(s)/Grant(s): F33615-96-2-1948; Proj-ARPA

Report No.(s): AD-A409388; AFRL-IF-WP-TM-2002-1567; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This document constitutes the final report to the revised Statement of Work for the Carnegie Mellon University Incremental Software Evolution for Real-Time Systems (INSERT) project under the DARPA Evolutionary Design for Complex Software (EDCS) Program. The INSERT team has completed an initial API definition and ported the existing real-time publication subscription group communication software to LynxOS 2.4, a POSIX.1b compliant OS. The distributed real-time publisher/subscriber communication model is now supported by a processor membership protocol which allows a node in the system to fail, or to rejoin the system later. When a node fails, all the publishers and subscribers on that node have to be deleted from the publisher/subscriber information maintained by the middleware layer. When a node tries to rejoin, the current state information about the publishers/subscribers must be transferred to the node before it can integrate into the system. A twophase protocol is used to ensure that the state information from the requested node is transferred in consistent fashion (since the information can be changing when the transfer happens). The message distribution list for distributed group communication is currently undergoing further evaluation in the context of real-time control experiments.

DTIC

*Computer Programs; Real Time Operation; Software Engineering*

**20030015830** Erc International, Inc., San Diego, CA USA

**SUPREM DSMC: A New Scalable, Parallel, Reacting, Multidimensional Direct Simulation Monte Carlo Flow Code**

Campbell, David; Wadsworth, Dean; Wysong, Ingrid; Kaplan, Carolyn; Feb. 29, 2000; 3p; In English

Contract(s)/Grant(s): AF Proj. 1011

Report No.(s): AD-A409492; AFRL-PR-ED-AB-2000-037; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

An AFRL/NRL team has recently been selected to develop a scalable, parallel, reacting, multidimensional Direct Simulation Monte Carlo (DSMC) code for the DoD user community under the High Performance Computing Modernization Office (HPCMO) Common HPC Software Support Initiative (CHSSI). This paper will introduce the Exhaust Plume community to this three year development effort and present the overall goals, schedule, and present status of this new code. The goal of this effort is to develop and transition to the DoD user community a modern, scalable DSMC code based on the integration of state-of-the-art collision models with advanced parallelization methods, gridding algorithms and data structures.

DTIC

*Computerized Simulation; Monte Carlo Method; Applications Programs (Computers); Mathematical Models; Algorithms*

**20030016576** Argonne National Lab., IL USA

**Goals Guiding Design: PVM and MPI**

Gropp, W.; Lusk, E.; 2002; 14p; In English

Report No.(s): DE2002-801650; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

PVM and MPI, two systems for programming clusters, are often compared. The comparisons usually start with the unspoken assumption that PVM and MPI represent different solutions to the same problem. In this paper we show that, in fact, the two systems often are solving different problems. In cases where the problems do match but the solutions chosen by PVM and MPI are different, we explain the reasons for the differences. Usually such differences can be traced to explicit differences in the goals of the two systems, their origins, or the relationship between their specifications and their implementations. For example, we show that the requirement for portability and performance across many platforms caused MPI to choose approaches different from those made by PVM, which is able to exploit the similarities of network-connected systems.

NTIS

*Problem Solving; Clusters*

**20030016577** Argonne National Lab., IL USA

**Clusters as Large-Scale Development Facilities**

Evard, R.; Desai, N.; Navarro, J. P.; Nurmi, D.; 2002; 14p; In English

Report No.(s): DE2002-801649; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

In this paper, we describe the use of a cluster as a generalized facility for development. A development facility is a system used primarily for testing and development activities while being operated reliably for many users. We are in the midst of a project to build and operate a large-scale development facility. We discuss our motivation for using clusters in this way and compare the model with a classic computing facility. We describe our experiences and findings from the first phase of this project. Many of these observations are relevant to the design of standard clusters and to future development facilities.

NTIS

*Clusters; Facilities*

**20030016677** Massachusetts Inst. of Tech., Aerospace Computational Design Lab., Cambridge, MA USA

**Development of an Output-based Adaptive Method for Multi-Dimensional Euler and Navier-Stokes Simulations** *Final Report*

Darmofal, David L., Massachusetts Inst. of Tech., USA; [2003]; 3p; In English

Contract(s)/Grant(s): NAG1-2275

Report No.(s): MIT-OSP-6890433; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The use of computational simulations in the prediction of complex aerodynamic flows is becoming increasingly prevalent in the design process within the aerospace industry. Continuing advancements in both computing technology and algorithmic development are ultimately leading to attempts at simulating ever-larger, more complex problems. However, by increasing the reliance on computational simulations in the design cycle, we must also increase the accuracy of these simulations in order to maintain or improve the reliability and safety of the resulting aircraft. At the same time, large-scale computational simulations must be made more affordable so that their potential benefits can be fully realized within the design cycle. Thus, a continuing need exists for increasing the accuracy and efficiency of computational algorithms such that computational fluid dynamics can become a viable tool in the design of more reliable, safer aircraft. The objective of this research was the development of an error estimation and grid adaptive strategy for reducing simulation errors in integral outputs (functionals) such as lift or drag from multi-dimensional Euler and Navier-Stokes simulations. In this final report, we summarize our work during this grant.

Author

*Navier-Stokes Equation; Euler Equations of Motion; Computational Fluid Dynamics; Error Analysis; Aerodynamic Drag*

**20030016724** Lawrence Livermore National Lab., Livermore, CA USA

**Scientific Software Component Technology**

Kohn, S.; Gannon, D.; Dykman, N.; Kumfert, G.; Smolinski, B.; Feb. 16, 2000; 30p; In English

Report No.(s): DE2002-792560; UCRL-ID-137578; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

This paper describes work in progress to develop a standard for interoperability among high-performance scientific components. This research stems from growing recognition that the scientific community needs to better manage the complexity of multidisciplinary simulations and better address scalable performance issues on parallel and distributed architectures.

NTIS

*Architecture (Computers); Computer Programs*

**20030017751** Technische Univ., Faculty of Civil Engineering, Delft, Netherlands

**Design, Implementation and Evaluation of a General Purpose Finite Element Software Package for Parallel Computers**

Lingen, E. J.; Oct. 1997; 62p; In English

Report No.(s): PB2003-102145; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The finite element (FE) method is a widely used numerical method for solving complex engineering problems. The solution of these problems, however, may require days of computer time, especially if the problems are non-linear. An attractive way to speed up these computations is to use parallel computers. Consequently, much effort has already been put into the development of FE programs for parallel computers. However, most of these programs are aimed at solving specific problems, and are based on specific solution procedures. The objective of this research is to develop a good design for a FE software package that can be used to solve a range of linear and non-linear engineering problems efficiently on different types of parallel computers. For this purpose, we have developed an experimental FE package, named ScaFiEP. This package is an object oriented software library which provides a flexible framework for building specific FE applications for parallel computers. It is based on the domain decomposition approach, in which the FE mesh is partitioned into a number of sub-meshes, or blocks. Multiple blocks may be assigned to one processor to facilitate dynamic load balancing. Although ScaFiEP has been designed with this purpose in mind, the load balancing algorithm itself has not yet been implemented.

NTIS

*Software Engineering; Design Analysis; Evaluation; Applications Programs (Computers); Finite Element Method; Parallel Processing (Computers)*

**20030017771** Research Inst. for Advanced Computer Science, Moffett Field, CA USA

**Learning Assumptions for Compositional Verification**

Cobleigh, Jamieson M., Research Inst. for Advanced Computer Science, USA; Giannakopoulou, Dimitra, Research Inst. for Advanced Computer Science, USA; Pasareanu, Corina, Research Inst. for Advanced Computer Science, USA; November 2002; 18p; In English; TACAS 2003 Conference, Unknown

Contract(s)/Grant(s): NAS2-00065; NCC2-1006

Report No.(s): RIACS-TR-02.09; Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche; Distribution under U.S. Government purpose rights under contract number NAS1-00065; Distribution under U.S. Government purpose rights under contract number NAS1-00065

Compositional verification is a promising approach to addressing the state explosion problem associated with model checking. One compositional technique advocates proving properties of a system by checking properties of its components in an assume-guarantee style. However, the application of this technique is difficult because it involves non-trivial human input. This paper presents a novel framework for performing assume-guarantee reasoning in an incremental and fully automated fashion. To check a component against a property, our approach generates assumptions that the environment needs to satisfy for the property to hold. These assumptions are then discharged on the rest of the system. Assumptions are computed by a learning algorithm. They are initially approximate, but become gradually more precise by means of counterexamples obtained by model checking the component and its environment, alternately. This iterative process may at any stage conclude that the property is either true or false in the system. We have implemented our approach in the LTSA tool and applied it to the analysis of a NASA system.

Author

*Proving; Models; Learning*

**20030017985** NASA Ames Research Center, Moffett Field, CA USA

**Generalized Symbolic Execution for Model Checking and Testing**

Khurshid, Sarfraz, Massachusetts Inst. of Tech., USA; Pasareanu, Corina, NASA Ames Research Center, USA; Visser, Willem, NASA Ames Research Center, USA; [2003]; 16p; In English; TACAS 2003 Conference, 2003, Unknown

Contract(s)/Grant(s): NAS2-00065; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Modern software systems, which often are concurrent and manipulate complex data structures must be extremely reliable. We present a novel framework based on symbolic execution, for automated checking of such systems. We provide a two-fold generalization of traditional symbolic execution based approaches: one, we define a program instrumentation, which enables standard model checkers to perform symbolic execution; two, we give a novel symbolic execution algorithm that handles dynamically allocated structures (e.g., lists and trees), method preconditions (e.g., acyclicity of lists), data (e.g., integers and strings) and concurrency. The program instrumentation enables a model checker to automatically explore program heap configurations (using a systematic treatment of aliasing) and manipulate logical formulae on program data values (using a decision procedure). We illustrate two applications of our framework: checking correctness of multi-threaded programs that take inputs from unbounded domains with complex structure and generation of non-isomorphic test inputs that satisfy a testing criterion. Our implementation for Java uses the Java PathFinder model checker.

Author

*Computer Systems Programs; Software Engineering; Mathematical Models; Performance Tests; Complex Systems*

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### COMPUTER SYSTEMS

*Includes computer networks and distributed processing systems. For information systems see 82 Documentation and Information Science. For computer systems applied to specific applications, see the associated category.*

**20030015815** Air Force Inst. of Tech., School of Engineering and Management, Wright-Patterson AFB, OH USA

**Performance Analysis of a Secure IEEE 802.11B Wireless Network Incorporating Personal Digital Assistants**

Camp, John L.; Jun. 2002; 151p; In English

Report No.(s): AD-A409461; AFIT/GCS/ENG/02-10; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

Research results of this thesis indicate very poor performance of a Wireless Local Area Network (WLAN) utilizing PDAs. Network throughput is adversely effected most by VPN implementation and slightly by increased file size. The client distance factor has virtually no effect on the throughput. The impact of each of these factor levels is small when compared to the magnitude of the overall mean throughput (less than 6%). The average network throughput with the PDA client is much lower than expected (=11,500 bps). This is attributed to several factors with degradation primarily resulting from limitations of the PDA hardware and O/S. Because of the low throughput values achieved (regardless if VPN is on or off), an operational WLAN with PDAs (as tested) is not feasible. Operational use of the network tested would require an in-depth analysis of the type of network traffic and performance required to maintain functionality. To deploy such a system, custom designed Winsock controls would need to be implemented to minimize limitations imposed by the PDA. As PDA technology continues to develop, future hardware and O/S

functionality may provide a more robust platform for network communications. The battery life of the PDA and packet battery combination is observed to be about 164 minutes with additional jackets adding about 90 minutes each.

DTIC

*Local Area Networks; Computers; Protocol (Computers); Data Transmission; Computer Information Security*

**20030016548** Instituto Nacional de Pesquisas Espaciais, Sao Jose dos Campos, Brazil

**Persistence Service to Distributed Environments Using Interface Repository Resources** *Servico de Persistencia Para Ambientes Distribuidos Explorando os Recursos do Repositorio de Interfaces*

Pereira, Patricia Maria, Instituto Nacional de Pesquisas Espaciais, Brazil; 2002; 132p; In Portuguese

Report No.(s): INPE-9254-TDI/816; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

This dissertation presents a new approach to the persistence of objects in distributed environments. Service persistence for a SICSD architecture was the focus of this research. SICSD architecture has shown itself to be both flexible and dynamic in the distributed environments of the satellite control software used at the Brazilian National Space Research Institute (INPE). The idea behind the SICSD architecture is to organize the software in objects so that they can migrate from one machine to another according to controller demands and according to the state of the computer network used to control the satellites. Communication within this distributed environment takes place through middleware that implements the CORBA (Common Object Request Broker) specification. The SICSD architecture makes common functions available to any application designed to control the satellites (telemetry processing, sending telecommands, etc.) It also provides for a variety of services necessary for the proper functioning of the distributed environment. The Proposed Persistence Service (PPS) for a SICSD architecture was designed to reduce the programming workload of software designers. With PPS, the designer does not have to write a code for the persistence of the objects. The designer only has to delegate the execution of the persistence process to PPS in the code lines. PPS innovates through the use of the Interface Repository. The Interface Repository is a resource found in the implementation of the CORBA specification. The repository contains information about the interfaces of the distributed objects in a CORBA-based system such as that found in the SICSD architecture. Using Interface Repository resources, PPS knows which attributes characterize the state of an object during execution, having the capacity to access its methods dynamically. This makes it possible to recover the state of the object from the memory and save it in the database. The advantage of exploring the Interface Repository derives from the fact that changes in object attributes are immediately reflected in its interface and, thus, available to the PPS. Moreover, the Interface Repository makes the PPS open to the addition of new objects without having to recompile the code.

Author

*Object-Oriented Programming; Architecture (Computers); Computer Networks*

**20030018416** Osaka City Univ., Dept. of Physical Electronics and Informatics, Japan

**Ad-Hoc Network Simulator Based on DSDV Routing Method**

Sugiyama, Hisayoshi, Osaka City Univ., Japan; Tsujioka, Tetsuo, Osaka City Univ., Japan; Murata, Masashi, Osaka City Univ., Japan; Memoirs of the Faculty of Engineering, Osaka City University; December 2002; ISSN 0078-6659; Volume 43, pp. 43-58; In English; Copyright; Avail: Issuing Activity

A simulator is introduced by which the operation of Ad-Hoc network is simulated on display screen of UNIX workstation. The routing protocol is based on Destination Sequence Distance Vector (DSDV). Number of nodes, communication range, broadcast frequency of forwarding table, and other parameters inherent in the DSDV protocol can be fixed arbitrary by 'Initialization File'. As the simulation step proceeds, noticeable events raised in the network operation are indicated graphically in the simulation window. Forwarding tables of each node are also indicated by other windows. Almost of all parameters can be changed arbitrary when the simulation pauses at the appointed time. Finally, the simulation results of each node including transmission collision time and wait time for avoiding that are recorded in data files.

Author

*UNIX (Operating System); Display Devices; Simulators; Protocol (Computers)*

## CYBERNETICS, ARTIFICIAL INTELLIGENCE AND ROBOTICS

*Includes feedback and control theory, information theory, machine learning, and expert systems. For related information see also 54 Man/System Technology and Life Support.*

**20030014750** NASA Ames Research Center, Moffett Field, CA USA

### **Advances in Robotic, Human, and Autonomous Systems for Missions of Space Exploration**

Gross, Anthony R., NASA Ames Research Center, USA; Briggs, Geoffrey A., NASA Ames Research Center, USA; Glass, Brian J., NASA Ames Research Center, USA; Pedersen, Liam, QSS Group, Inc., USA; Kortenkamp, David M., Metrica, Inc., USA; Wettergreen, David S., Carnegie-Mellon Univ., USA; Nourbakhsh, I., Carnegie-Mellon Univ., USA; Clancy, Daniel J., NASA Ames Research Center, USA; [2002]; 5p; In English; 53rd International Astronautical Congress, 10-19 Oct. 2002, Houston, TX, USA; Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Distribution as joint owner in the copyright; Distribution as joint owner in the copyright

Space exploration missions are evolving toward more complex architectures involving more capable robotic systems, new levels of human and robotic interaction, and increasingly autonomous systems. How this evolving mix of advanced capabilities will be utilized in the design of new missions is a subject of much current interest. Cost and risk constraints also play a key role in the development of new missions, resulting in a complex interplay of a broad range of factors in the mission development and planning of new missions. This paper will discuss how human, robotic, and autonomous systems could be used in advanced space exploration missions. In particular, a recently completed survey of the state of the art and the potential future of robotic systems, as well as new experiments utilizing human and robotic approaches will be described. Finally, there will be a discussion of how best to utilize these various approaches for meeting space exploration goals.

Author

*Space Missions; Autonomy; Robotics; Man Machine Systems; Mission Planning; Space Exploration*

**20030015757** NASA Langley Research Center, Hampton, VA USA

### **NASA Synthetic Vision EGE Flight Test**

Prinzel, Lawrence J., NASA Langley Research Center, USA; Kramer, Lynda J., NASA Langley Research Center, USA; Comstock, J. Raymond, NASA Langley Research Center, USA; Bailey, Randall E., NASA Langley Research Center, USA; Hughes, Monica F., NASA Langley Research Center, USA; Parrish, Russell V., NASA Langley Research Center, USA; [2002]; 5p; In English; 46th Human Factors and Ergonomic Society Meeting, 30 Sep. - 4 Oct. 2002, Baltimore, MD, USA; Sponsored by Human Factors and Ergonomic Society, USA; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

NASA Langley Research Center conducted flight tests at the Eagle County, Colorado airport to evaluate synthetic vision concepts. Three display concepts (size 'A' head-down, size 'X' head-down, and head-up displays) and two texture concepts (photo, generic) were assessed for situation awareness and flight technical error / performance while making approaches to Runway 25 and Runway 07 and simulated engine-out Cottonwood 2 and KREMM departures. The results of the study confirm the retrofit capability of the HUD and Size 'A' SVS concepts to significantly improve situation awareness and performance over current EFIS glass and non-glass instruments for difficult approaches in terrain-challenged environments.

Author

*Enhanced Vision; Display Devices; Flight Tests; Situational Awareness; Pilot Performance*

**20030016537** Fluor Daniel Hanford, Inc., Richland, WA USA

### **Acceptance Test Report for the Modular Automation System (MAS) Manufactured by Honeywell Inc**

Anderson, D. L.; 2000; 46p; In English

Report No.(s): DE2002-801322; HNF-5483; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

This document details the performance of the acceptance test of the Honeywell MAS Control System for equipment to be installed in glove boxes HA-20MB and HA-211 at a later date. Equipment that was anticipated included 6 stabilization furnaces, only three and their associated equipment were installed. A copy of the completed acceptance test plan(ATP) is in the appendix of this document.

NTIS

*Automation; Automatic Control; Stabilization; Handling Equipment*

**20030016567** Instituto Nacional de Pesquisas Espaciais, Sao Jose dos Campos, Brazil

**Parameters Identification and Failure Detection Applied to Space Manipulators *Identificacao de Parametros e Deteccao de Falhas Aplicada a Manipuladores Espaciais***

RobertodaSilva, Adenilson, Instituto Nacional de Pesquisas Espaciais, Brazil; 2002; 202p; In Portuguese  
Report No.(s): INPE-8981-TDI/812/A; No Copyright; Avail: CASI; A10, Hardcopy; A03, Microfiche

Physical parameters identification is useful in many applications, especially in aerospace and robotics fields. Aerospace and robotics system analysis normally requires accurate physical system models for control. On the other hand, the identification of physical parameters, besides the normal identification requirements (system excitation, for instance), involves several tasks: mathematical modeling and algorithm selection for instance. In this thesis, a detailed modeling of a robotic joint has been presented. The models are derived in an increasing degree of complexity (which means that, in theory, the mathematical representation is approaching to the real system), where the typical non-linear terms of a robotic joint have been taken into account. A new procedure to select suitable robotic trajectories based on the singular value decomposition (SVD) of measurement matrix is also presented. The identification task has been carried out by deriving (or improving) and implementing new algorithms. The strategies and algorithms have shown good performance in both: accuracy and also concerning computer load. In order to allow the inclusion of non linear terms in the parameters vector, a new algorithm (TS -Two Step Algorithm) based on a modified version of Recursive Least Squares (mRLS) with a variable forgetting factor and MCS (Multi Level Coordinate Search) algorithms has been derived. The results have shown that the TS algorithm have excellent performance in identifying the unknown parameters vector by using both: real and simulate data. In addition, an integrated procedure for sensors failure detection and isolation (FDI) based on subspace theory is derived. The MOESP (MIMO Output Error State Space Model Identification) algorithm has been used to build a model, which serve as a reference for the FDI algorithm. The FDI algorithm has shown high reliability in detect and isolate all the simulated failures in the sensors. Finally, the TS and the FDI algorithms have been integrated in a single environment to simulate integrated situations where the system is time variant and the sensors also fail. The results have shown that reliable parameters are obtained even in case of multi failure. All derived models and algorithms have been tested by using data collected from IRJ (Intelligent Robotic Joint) experiment build at DLR (German Aerospace Centers) Oberpfaffenhofen.

Author

*Parameter Identification; Failure Analysis; Fault Detection; Manipulators; Robotics*

**20030017989** Princess Sumaya Univ., Dept. of Computer Science, Amman, Jordan

**Innovative Trends in Knowledge Based Logical Reasoning in the Field of COMADEM**

Obeid, Nadim, Princess Sumaya Univ., Jordan; Rao, Raj B. K. N., COMADEM International, UK; International Journal of COMADEM; July 2002; ISSN 1363-7681; Volume 5, No. 3, pp. 5-13; In English; Copyright; Avail: Issuing Activity

We present in this paper, a logical framework that sets firmly the knowledge based-diagnostic discipline in the context of a theory of events and change, where time is explicitly represented. We employ a Temporal First Order Nonmonotonic Logic extended with events (Extended TFONL) to represent and reason with different types of knowledge (structural, behavioral, causal, qualitative and heuristic) used in different diagnostic systems and approaches. The framework allows us to take advantage of both the model-based and the heuristic approaches to diagnosis. We present a definition of diagnosis in terms of a diagnostic model - a particular model of the failing components and the successful occurrences of the events that contribute to the fault(s).

Author

*Knowledge Based Systems; Artificial Intelligence; Logic Programming; Temporal Logic; Diagnosis*

**20030018259** Karnataka Univ., NMAM Inst. of Technology, India

**Radial Basis Function Neural Networks for Tool Wear Condition Monitoring**

Pai, P. Srinivasa, Karnataka Univ., India; Nagabhushana, T. N., Karnataka Univ., India; Rao, P. K. Ramakrishna, Karnataka Univ., India; Rao, Raj B. K. N., COMADEM International, UK; International Journal of COMADEM; July 2002; ISSN 1363-7681; Volume 5, No. 3, pp. 21-30; In English; Copyright; Avail: Issuing Activity

This paper presents a novel application of Radial Basis Function (RBF) neural networks for tool wear condition monitoring by employing Acoustic Emission technique and Surface Roughness parameters during face milling operations. RBF neural networks are characterized by two parameters, a center ( $x(\text{sub } j)$ ) and a width ( $\sigma(\text{sub } j)$ ). The influence of these two parameters on the performance of the network has been evaluated for different tool wear conditions in face milling operations and the results discussed.

Author

*Neural Nets; Acoustic Emission; Surface Roughness; Systems Health Monitoring; Gears; Failure Analysis*

*Includes iteration, differential and difference equations, and numerical approximation.*

**20030014809** NASA Goddard Space Flight Center, Greenbelt, MD USA

**On the Singularity in the Estimation of the Quaternion-of-Rotation**

Bar-Itzhack, Itzhack Y., Israel Inst. of Tech., Israel; Thienel, Julie K., NASA Goddard Space Flight Center, USA; [2002]; 11p; In English; AIAA/AAS Astrodynamics Specialist Conference, 5-8 Aug. 2002, Monterey, CA, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Report No.(s): AIAA Paper 2002-4831; Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche; Distribution as joint owner in the copyright; Distribution as joint owner in the copyright

It has been claimed in the archival literature that the covariance matrix of a Kalman filter, which is designed to estimate the quaternion-of-rotation, is necessarily rank deficient because the normality constraint of the quaternion produces dependence between the quaternion elements. In reality, though, this phenomenon does not occur. The covariance matrix is not singular, and the filter is well behaved. Several simple examples are presented that demonstrate the regularity of the covariance matrix. First, a Kalman filter is designed to estimate variables subject to a functional relationship. Then the particular problem of quaternion estimation is analyzed. It is shown that the discrepancy stems from the fact that the functional relationship exists between the elements of the quaternion but not between its estimate elements.

Author

*Covariance; Matrices (Mathematics); Quaternions; Rotation*

**20030014812** NASA Marshall Space Flight Center, Huntsville, AL USA

**Nonlinear Pressurization and Modal Analysis Procedure for Dynamic Modeling of Inflatable Structures**

Smalley, Kurt B., Clarkson Univ., USA; Tinker, Michael L., NASA Marshall Space Flight Center, USA; Journal of Spacecraft and Rockets; 2002; ISSN 0022-4650; Volume 39, No. 5, pp. 1-8; In English; Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche; Distribution as joint owner in the copyright; Distribution as joint owner in the copyright

An introduction and set of guidelines for finite element dynamic modeling of nonrigidized inflatable structures is provided. A two-step approach is presented, involving 1) nonlinear static pressurization of the structure and updating of the stiffness matrix and 2) linear normal modes analysis using the updated stiffness. Advantages of this approach are that it provides physical realism in modeling of pressure stiffening, and it maintains the analytical convenience of a standard linear eigensolution once the stiffness has been modified. Demonstration of the approach is accomplished through the creation and test verification of an inflated cylinder model using a large commercial finite element code. Good frequency and mode shape comparisons are obtained with test data and previous modeling efforts, verifying the accuracy of the technique. Problems encountered in the application of the approach, as well as their solutions, are discussed in detail.

Author

*Nonlinearity; Dynamic Characteristics; Inflatable Structures; Pressure*

**20030015244** NASA Ames Research Center, Moffett Field, CA USA

**Locally-Based Kernel PLS Smoothing to Non-Parametric Regression Curve Fitting**

Rosipal, Roman, NASA Ames Research Center, USA; Trejo, Leonard J., NASA Ames Research Center, USA; Wheeler, Kevin, NASA Ames Research Center, USA; [2002]; 36p; In English; Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche; Distribution as joint owner in the copyright; Distribution as joint owner in the copyright

We present a novel smoothing approach to non-parametric regression curve fitting. This is based on kernel partial least squares (PLS) regression in reproducing kernel Hilbert space. It is our concern to apply the methodology for smoothing experimental data where some level of knowledge about the approximate shape, local inhomogeneities or points where the desired function changes its curvature is known a priori or can be derived based on the observed noisy data. We propose locally-based kernel PLS regression that extends the previous kernel PLS methodology by incorporating this knowledge. We compare our approach with existing smoothing splines, hybrid adaptive splines and wavelet shrinkage techniques on two generated data sets.

Author

*Kernel Functions; Curve Fitting; Data Smoothing; Functions (Mathematics); Least Squares Method; Regression Analysis; Noise Reduction*

**20030015724** NASA Ames Research Center, Moffett Field, CA USA

**High-Order Spectral Volume Method for 2D Euler Equations**

Wang, Z. J., Michigan State Univ., USA; Zhang, Laiping, Michigan State Univ., USA; Liu, Yen, NASA Ames Research Center, USA; Nov. 15, 2002; 10p; In English; 16th AIAA CFD Conference, 23-26 Jun. 2003, Orlando, FL, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA; Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche; Distribution as joint owner in the copyright; Distribution as joint owner in the copyright

The Spectral Volume (SV) method is extended to the 2D Euler equations. The focus of this paper is to study the performance of the SV method on multidimensional non-linear systems. Implementation details including total variation diminishing (TVD) and total variation bounded (TVB) limiters are presented. Solutions with both smooth features and discontinuities are utilized to demonstrate the overall capability of the SV method.

Author

*Differential Equations; Spectral Methods; Computational Fluid Dynamics; Spectrum Analysis; TVD Schemes; Unstructured Grids (Mathematics); Finite Volume Method*

**20030015743** Lawrence Livermore National Lab., Livermore, CA USA

**3-D Elastic Numerical Modeling of a Complex Salt Structure**

House, L.; Larsen, S.; Bednar, J. B.; Feb. 17, 2000; In English; This document is color dependent and/or in landscape layout. It is currently available on CD-ROM

Report No.(s): DE2002-792717; UCRL-JC-137646; No Copyright; Avail: National Technical Information Service (NTIS)

Reliably processing, imaging, and interpreting seismic data from areas with complicated structures, such as sub-salt, requires a thorough understanding of elastic as well as acoustic wave propagation. Elastic numerical modeling is an essential tool to develop that understanding. While 2-D elastic modeling is in common use, 3-D elastic modeling has been too computationally intensive to be used routinely. Recent advances in computing hardware, including commodity-based hardware, have substantially reduced computing costs. These advances are making 3-D elastic numerical modeling more feasible. A series of example 3-D elastic calculations were performed using a complicated structure, the SEG/EAGE salt structure. The synthetic traces show that the effects of shear wave propagation can be important for imaging and interpretation of images, and also for AVO and other applications that rely on trace amplitudes. Additional calculations are needed to better identify and understand the complex wave propagation effects produced in complicated structures, such as the SEG/EAGE salt structure.

NTIS

*Wave Propagation; Imaging Techniques; Mathematical Models*

**20030015756** NASA Langley Research Center, Hampton, VA USA

**Simple Numerical Simulation of Strain Measurement**

Tai, H., NASA Langley Research Center, USA; [2002]; 12p; In English; 47th Annual Meeting International Symposium on Optical Science and Technology, 7-11 Jul. 2002, Seattle, WA, USA; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

By adopting the basic principle of the reflection (and transmission) of a plane polarized electromagnetic wave incident normal to a stack of films of alternating refractive index, a simple numerical code was written to simulate the maximum reflectivity (transmittivity) of a fiber optic Bragg grating corresponding to various non-uniform strain conditions including photo-elastic effect in certain cases.

Author

*Numerical Analysis; Strain Measurement; Reflectance; Bragg Gratings; Photoelastic Analysis; Nonuniformity*

**20030016674** Florida State Univ., Tallahassee, FL USA

**A Stochastic Collocation Algorithm for Uncertainty Analysis Final Report, Apr. - Dec. 2002**

Mathelin, Lionel, Florida State Univ., USA; Hussaini, M. Yousuff, Florida State Univ., USA; February 2003; 16p; In English Contract(s)/Grant(s): NCC1-02025; RTOP 706-20-61-01

Report No.(s): NASA/CR-2003-212153; NAS 1.26:212153; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report describes a stochastic collocation method to adequately handle a physically intrinsic uncertainty in the variables of a numerical simulation. For instance, while the standard Galerkin approach to Polynomial Chaos requires multi-dimensional summations over the stochastic basis functions, the stochastic collocation method enables to collapse those summations to a one-dimensional summation only. This report furnishes the essential algorithmic details of the new stochastic collocation method

and provides as a numerical example the solution of the Riemann problem with the stochastic collocation method used for the discretization of the stochastic parameters.

Author

*Stochastic Processes; Algorithms; Uncertain Systems; Galerkin Method*

**20030016708** Helsinki Univ. of Technology, Dept. of Engineering Physics and Mathematics, Espoo Finland

**Numerical Calculations on Vortex Phenomena in Helium Superfluids**

Kopu, J.; 2001; 40p; In English

Report No.(s): PB2003-102630; Copyright; Avail: National Technical Information Service (NTIS), Microfiche

This thesis reports numerical calculations on quantized vortices in 4He and 3He superfluids. Vortices are of crucial importance in understanding many of the superfluid properties. All the calculations presented in the thesis have experimental relevance, either in understanding measured results or in predicting the outcome of planned experiments.

NTIS

*Numerical Analysis; Helium; Vortices; Predictions*

**20030017788** Institute of Global Environment and Society, Inc., Center for Ocean-Land-Atmosphere Studies, Calverton, MD USA

**Limits of Predictability Determined by Optimal Persistence Patterns**

Delsole, Tim, Institute of Global Environment and Society, Inc., USA; Prospects for Improved Forecasts of Weather and Short-Term Climate Variability on Subseasonal (2-Week to 2-Month) Times Scales; November 2002; Volume 23, pp. 72; In English; Also announced as 20030017775; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

In this talk I introduce the concept of an optimal persistence pattern and discuss how it can be used to define limits of predictability strictly from observations. An optimal persistence pattern (OPP) is a component of a time-varying field that remains auto-correlated for the longest time-lags. Techniques for extracting OPPs provide an efficient method not only for isolating persistent patterns in stationary time series, but also for detecting trends, discontinuities, and other low-frequency signals in nonstationary time series. In this talk, we discuss how OPPs can be used to filter out low-frequency signals to render a time series stationary, then used to determine the patterns with the maximum decorrelation time. This approach clarifies the fundamental time scales of phenomena such as the PNA, NAO, etc. The resulting patterns can be shown to provide a rigorous upper limit of predictability for all linear prediction models. The skill of statistical predictions of the leading OPPs will be discussed.

Author

*Mathematical Models; Variations; Linear Prediction; Detection*

**20030017789** National Centers for Environmental Prediction, Climate Prediction Center, USA

**Variability Within the PNA, NAO, and AO Regimes On Sub-Seasonal Time Scales**

Chen, Wilbur Y., National Centers for Environmental Prediction, USA; Prospects for Improved Forecasts of Weather and Short-Term Climate Variability on Subseasonal (2-Week to 2-Month) Times Scales; November 2002; Volume 23, pp. 73-76; In English; Also announced as 20030017775; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

Variability over the oceans is much more prominent than over the lands, as shown in Fig. 1. Its impacts on remote regions through teleconnections are well recognized. For instance, PNA and TNH patterns show impact of the Pacific sector on North America sector. Both PNA and TNH teleconnections can develop due to tropical forcing and/or intrinsic internal dynamics. This study focuses on the latter. That is, through the intrinsic internal dynamical processes, how does a large oceanic variability impact North America? Particular attention is focused on the variability of a teleconnection pattern within the PNA, NAO, and AO regimes.

Derived from text

*Variability; Time Functions; Teleconnections (Meteorology); Annual Variations*

*Includes data sampling and smoothing; Monte Carlo method; time series and analysis; and stochastic processes.*

**20030015252** Alphatech, Inc., Burlington, MA USA

**Model Predictive Control for Dynamic Unreliable Resource Allocation**

Castanon, David A.; Wohletz, Jerry M.; Dec. 2002; 8p; In English

Contract(s)/Grant(s): F33615-01-C-3149; Proj-ARPF

Report No.(s): AD-A409519; AFRL-VA-WP-TR-2002-334; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

In this paper, we consider a class of unreliable resource allocation problems where resources assigned may fail to complete a task, and the outcomes of past resource allocations are observed before new resource allocations are selected. The resulting temporal allocation problem is a stochastic control problem, with a state space and control space that grow exponentially in cardinality with the number of tasks. We introduce an approximation by enlarging the admissible control space, and show that this approximation can be solved exactly and efficiently. The approximation is used in a model predictive control (MPC) algorithm. For single resource problems, the MPC algorithm completes over 98 percent of the task value completed by an optimal dynamic programming algorithm in over 1,000 randomly generated problems. On average, it achieves 99.5 percent of the optimal performance while requiring over 6 orders of magnitude less commutation.

DTIC

*Resource Allocation; Dynamic Programming; Failure; Commutation*

**20030015781** Universitaet der Bundeswehr, Fachbereich Wirtschafts und Organisationswissenschaften, Hamburg, Germany

**Double Sample Plans for Qualitative and Quantitative Features with Minimal Maximal Average Sample Number (ASN)**

***Zweifache Stichprobenpruefplaene fuer Qualitative und Quantitative Merkmale mit Minimaler Maximaler ASN***

Mueller, Kai; Jan. 1998; 69p; In German

Report No.(s): AD-A409369; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The dissertation involves statistical efficiency and control. After a brief preface, the second chapter introduces the notions of the single and double sample plans for attributives, then follows with the determination of double sample plans for attributives with minimal maximal Average Sampler Number (ASN) in chapter three. Chapter four features single and double variable sample plans and, as expected, chapter five provides the determination of these plans with minimal maximal ASN. The end result responds to a concern as regards the QS, or quality control, that is used in general statistics, the goal in business being the more improved coordination of production control and acceptance sampling.

DTIC

*Statistical Analysis; Sampling*

**20030016705** Lawrence Livermore National Lab., Livermore, CA USA

**X-Ray Attenuation Cell**

Ryutov, D.; Toor, A.; Mar. 03, 2000; 20p; In English

Report No.(s): DE2002-792764; UCRL-ID-138125; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

To minimize the pulse-to-pulse variation, the LCLS FEL must operate at saturation, i.e. 10 orders of magnitude brighter spectral brilliance than 3rd-generation light sources. At this intensity, ultra-high vacuums and windowless transport are required. Many of the experiments, however, will need to be conducted at a much lower intensity thereby requiring a reliable means to reduce the x-ray intensity by many orders of magnitude without increasing the pulse-to-pulse variation. In this report we consider a possible solution for controlled attenuation of the LCLS x-ray radiation. We suggest using for this purpose a windowless gas-filled cell with the differential pumping. Although this scheme is easily realizable in principle, it has to be demonstrated that the attenuator can be made short enough to be practical and that the gas loads delivered to the vacuum line of sight (LOS) are acceptable. We are not going to present a final, optimized design. Instead, we will provide a preliminary analysis showing that the whole concept is robust and is worth further study.

NTIS

*Attenuators; X Rays; Light Sources; Spectra*

**20030017772** Analex Corp., Brook Park, OH USA

**Higher Order Modulation Intersymbol Interference Caused by Traveling-Wave Tube Amplifiers**

Kory, Carol L., Analex Corp., USA; Andro, Monty, NASA Glenn Research Center, USA; [2002]; 11p; In English; 20th AIAA International Communication Satellite Systems Conference and Exhibit, 12-15 May 2002, Montreal, Quebec, Canada; Sponsored

by American Inst. of Aeronautics and Astronautics, USA

Contract(s)/Grant(s): NAS3-00145

Report No.(s): AIAA Paper 2002-1896; Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche; Distribution under U.S. Government purpose rights; Distribution under U.S. Government purpose rights

For the first time, a time-dependent, physics-based computational model has been used to provide a direct description of the effects of the traveling wave tube amplifier (TWTA) on modulated digital signals. The TWT model comprehensively takes into account the effects of frequency dependent AM/AM and AM/PM conversion; gain and phase ripple; drive-induced oscillations; harmonic generation; intermodulation products; and backward waves. Thus, signal integrity can be investigated in the presence of these sources of potential distortion as a function of the physical geometry and operating characteristics of the high power amplifier and the operational digital signal. This method promises superior predictive fidelity compared to methods using TWT models based on swept-amplitude and/or swept-frequency data. First, the TWT model using the three dimensional (3D) electromagnetic code MAFIA is presented. Then, this comprehensive model is used to investigate approximations made in conventional TWT black-box models used in communication system level simulations. To quantitatively demonstrate the effects these approximations have on digital signal performance predictions, including intersymbol interference (ISI), the MAFIA results are compared to the system level analysis tool, Signal Processing, Workstation (SPW), using high order modulation schemes including 16 and 64-QAM.

Author

*Traveling Wave Amplifiers; Intersymbolic Interference; Modulation; Digital Techniques*

## 66

### SYSTEMS ANALYSIS AND OPERATIONS RESEARCH

*Includes mathematical modeling of systems; network analysis; mathematical programming; decision theory; and game theory.*

**20030014822** NASA Ames Research Center, Moffett Field, CA USA

#### **The Livingstone Model of a Main Propulsion System**

Bajwa, Anupa, Research Inst. for Advanced Computer Science, USA; Sweet, Adam, QSS Group, Inc., USA; [2003]; 8p; In English; IEEE Aero Conference, 8-15 Mar. 2003, Big Sky, MT, USA; Sponsored by Institute of Electrical and Electronics Engineers, USA

Contract(s)/Grant(s): NCC2-1006

Report No.(s): IEEEAC Paper 1444; ISBN 0-7803-7651-X; Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche; Distribution as joint owner in the copyright under cooperative agreement NCC2-1006; Distribution as joint owner in the copyright under cooperative agreement NCC2-1006

Livingstone is a discrete, propositional logic-based inference engine that has been used for diagnosis of physical systems. We present a component-based model of a Main Propulsion System (MPS) and say how it is used with Livingstone (L2) in order to implement a diagnostic system for integrated vehicle health management (IVHM) for the Propulsion IVHM Technology Experiment (PITEX). We start by discussing the process of conceptualizing such a model. We describe graphical tools that facilitated the generation of the model. The model is composed of components (which map onto physical components), connections between components and constraints. A component is specified by variables, with a set of discrete, qualitative values for each variable in its local nominal and failure modes. For each mode, the model specifies the component's behavior and transitions. We describe the MPS components' nominal and fault modes and associated Livingstone variables and data structures. Given this model, and observed external commands and observations from the system, Livingstone tracks the state of the MPS over discrete time-steps by choosing trajectories that are consistent with observations. We briefly discuss how the compiled model fits into the overall PITEX architecture. Finally we summarize our modeling experience, discuss advantages and disadvantages of our approach, and suggest enhancements to the modeling process.

Author

*Propulsion; Failure Modes; Mathematical Logic; Data Structures; Diagnosis*

**20030015772** Naval Postgraduate School, Monterey, CA USA

#### **Department of Operations Research**

Eagle, James D.; Wood, Kevin R.; Dec. 2001; 81p; In English

Report No.(s): AD-A409352; NPS-09-02-008; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

This report contains project summaries of the research projects in the Department of Operations Research. A list of recent publications is also included, which consists of conference presentations and publications, books, contributions to books, published journal papers, and technical reports. Thesis abstracts of students advised by faculty in the Department are also included.

DTIC

*Operations Research; Students*

**20030016513** Instituto Nacional de Pesquisas Espaciais, Sao Jose dos Campos, Brazil

**A Mathematical Model for the Mechanical Behavior of Mario Schenberg Gravitational Wave Detector** *Modelagem Matematica do Comportamento Mecanico do Detector de Ondas Gravitacionais "Mario Schenberg"*

Costa, Cesar Augusto, Instituto Nacional de Pesquisas Espaciais, Brazil; 2002; 136p; In Portuguese; Original contains color illustrations

Report No.(s): INPE-8877-TDI/807; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

The main goal of this work is to mathematically model the mechanical behavior of the Mario Schenberg detector. The physical parameters that affect this behavior are studied. The model gives the resonance frequencies of the system when two-mode mechanical resonators are coupled, following the arrangement suggested by Johnson and Merkwitz. It is also calculated how the system behaves under a gravitational sinewave quadrupolar force. An estimate of the noise sources contribution to the system movement is presented, as well as the equation for its calculation. This work also gives a short review on gravitational radiation, its generation by astrophysical sources and its detection.

Author

*Gravitational Waves; Mathematical Models; Mechanical Properties; Resonant Frequencies; Gravitational Wave Antennas*

## 67

### THEORETICAL MATHEMATICS

*Includes algebra, functional analysis, geometry, topology set theory, group theory and and number theory.*

**20030017992** ABB Industrial IT Development Center, Unit 1, Bangalore, India

**Chaos Mathematics and its Applications in the Field of Condition Monitoring**

Paithankar, Amit A., ABB Industrial IT Development Center, India; Rao, Raj B. K. N., COMADEM International, UK; Singh, N. M., Veermata Jujabai Technological Inst., India; International Journal of COMADEM; July 2002; ISSN 1363-7681; Volume 5, No. 3, pp. 39-44; In English; Copyright; Avail: Issuing Activity

The key objectives in a condition monitoring exercise include evaluating the status of equipment and predicting any incipient faults. Many of the material degradation process like mechanical cracking, fracture, electrical treeing and electrical tracking are nonlinear in nature and behave chaotically. From a system standpoint also many industrial processes are non linear in nature. Hence we can apply chaos mathematics for evaluation of the present state of industrial equipment and for prognosis. This paper briefly notes relevant tenets of chaos mathematics and then discusses two areas where chaos mathematics can be applied: (1) Electrical insulation related problems; (2) Mechanical material degradation and fatigue

Author

*Chaos; Mathematical Models; Systems Health Monitoring; Fault Detection; Gears; Fractals*

## 70

### PHYSICS (GENERAL)

*Includes general research topics related to mechanics, kinetics, magnetism, and electrodynamics. For specific areas of physics see categories 71 through 77. For related instrumentation see 35 Instrumentation and Photography; for geophysics, astrophysics or solar physics see 46 Geophysics, 90 Astrophysics, or 92 Solar Physics.*

**20030015790** Johns Hopkins Univ., Dept. of Mechanical Engineering, Baltimore, MD USA

**Thermo-Fluid Mechanic Study of Thermoacoustic Devices** *Final Report, 1 Oct. 1993-31 Dec. 2001*

Prosperetti, Andrea; Herman, Cila; Knio, Omar; Jun. 15, 2002; 102p; In English; Original contains color images

Contract(s)/Grant(s): N00014-94-1-0063

Report No.(s): AD-A409381; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

The research described is articulated in three parts: a) Development and study of a quasi-one-dimensional, time-domain, non-linear, simplified model of a thermoacoustic device. b) Multidimensional numerical modeling based on low-Mach-number

asymptotics. c) Visualization of high-speed oscillating temperature fields in a thermoacoustic stack by means of holographic interferometry combined with high-speed cinematography.

DTIC

*Flow Visualization; Thermoacoustic Refrigerators*

**20030015834** Sparta, Inc., Edwards AFB, CA USA

**Modeling of Interfacial Fracture in Photoelastic Specimens**

Miller, Timothy C.; Jun. 1998; 13p; In English; viewgraphs only

Contract(s)/Grant(s): AF Proj. 1011

Report No.(s): AD-A409498; AFRL-PR-ED-TP-1998-104; No Copyright; Avail: Defense Technical Information Center (DTIC)

Viewgraphs of presentation given on the modeling of interfacial fracture in photoelastic specimens.

DTIC

*Composite Materials; Photoelastic Materials; Interfacial Tension; Mathematical Models; Fracture Mechanics*

**20030016518** Lawrence Livermore National Lab., Livermore, CA USA

**Controlling Dose to Low Z Solids at LCLS**

Bionta, R. M.; Jan. 03, 2000; In English

Report No.(s): DE2002-792350; UCRL-ID-137222; No Copyright; Avail: CASI; C01, CD-ROM

Calculations of the dose suffered by the low Z solids, Li, Be, B, B(sub 4)C, BeO and C at various points along the LCLS beamline as a function of FEL photon energy are presented. Specific column densities of attenuator gases necessary to control the dose to C are calculated for assumed damage thresholds of 0.1 eV/atom and 0.01 eV/atom.

NTIS

*Gases; Photons; Free Electron Lasers; Attenuators*

**20030016555** Lawrence Livermore National Lab., Livermore, CA USA

**Reconstruction of Initial Beam Conditions at the Exit of the DARHT-II Accelerator**

Paul, A. C.; Feb. 18, 2000; 38p; In English

Report No.(s): DE2002-792445; UCRL-ID-137926; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

No abstract available.

NTIS

*Linear Accelerators; Beams (Radiation)*

**20030016573** Lawrence Livermore National Lab., Livermore, CA USA

**Single Fluorescent Molecule Confocal Microscopy: A New Tool for Molecular Biology Research and Biosensor Development**

Darrow, C.; Huser, T.; Campos, C.; Yan, M.; Lane, S.; Feb. 11, 2000; 12p; In English

Report No.(s): DE2002-792442; UCRL-ID-137921; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Our original proposal was presented to the LDRD committee on February 18, 1999. The revised proposal that followed incorporated changes that addressed the issues, concerns, and suggestions put forth by the committee members both during the presentation and in subsequent discussions we had with individual committee members. The goal of the proposal was to establish an SMD confocal microscopy capability and technology base at LLNL. Here we report on our progress during the 6-month period for which funding was available.

NTIS

*Microscopy; Molecular Biology; Bioinstrumentation*

**20030016709** Royal Inst. of Tech., Stockholm, Sweden

**Free Boundary Problem Related to Single-Layer Potentials**

Ebenfelt, P.; Khavinson, D.; Shapiro, H. S.; 2002; 30p; In English

Report No.(s): PB2003-102627; Copyright; Avail: National Technical Information Service (NTIS), Microfiche

No abstract available.

NTIS

*Boundary Value Problems; Free Boundaries*

**20030017833** NASA Ames Research Center, Moffett Field, CA USA

**Characterization of High-Frequency Excitation of a Wake by Simulation**

Cain, Alan B., Innovative Technology Applications Co., USA; Rogers, Michael M., NASA Ames Research Center, USA; Kibens, Valdis, Boeing Co., USA; [2003]; 12p; In English; AIAA Aerospace Sciences Meeting, 6-9 Jan. 2003, Reno, NV, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Report No.(s): AIAA Paper 2003-0179; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Insights into the effects of high-frequency forcing on free shear layer evolution are gained through analysis of several direct numerical simulations. High-frequency forcing of a fully turbulent plane wake results in only a weak transient effect. On the other hand, significant changes in the developed turbulent state may result when high-frequency forcing is applied to a transitional wake. The impacts of varying the characteristics of the high-frequency forcing are examined, particularly, the streamwise wavenumber band in which forcing is applied and the initial amplitude of the forcing. The high-frequency excitation is found to increase the dissipation rate of turbulent kinetic energy, to reduce the turbulent kinetic energy production rate, and to reduce the turbulent kinetic energy suppression increases with forcing amplitude once a threshold level has been reached. For a given initial forcing energy, the largest reduction in turbulent kinetic energy density was achieved by forcing wavenumbers that are about two to three times the neutral wavenumber determined from linear stability theory.

Author

*Energy Dissipation; Excitation; High Frequencies; Turbulent Wakes*

**71  
ACOUSTICS**

*Includes sound generation, transmission, and attenuation. For noise pollution see 45 Environment Pollution. For aircraft noise see also 02 Aerodynamics and 07 Aircraft Propulsion Propulsion and Power.*

**20030014944** NASA Langley Research Center, Hampton, VA USA

**The Acoustic Analogy and Alternative Theories for Jet Noise Prediction**

Morris, Philip J., Pennsylvania State Univ., USA; Farassat, F., NASA Langley Research Center, USA; [2002]; 43p; In English; Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche; Distribution as joint owner in the copyright; Distribution as joint owner in the copyright

This paper describes several methods for the prediction of jet noise. All but one of the noise prediction schemes are based on Lighthill's or Lilley's acoustic analogy while the other is the jet noise generation model recently proposed by Tam and Auriault. In all the approaches some assumptions must be made concerning the statistical properties of the turbulent sources. In each case the characteristic scales of the turbulence are obtained from a solution of the Reynolds-averaged Navier Stokes equation using a  $k - \epsilon$  turbulence model. It is shown that, for the same level of empiricism, Tam and Auriault's model yields better agreement with experimental noise measurements than the acoustic analogy. It is then shown that this result is not because of some fundamental flaw in the acoustic analogy approach: but, is associated with the assumptions made in the approximation of the turbulent source statistics. If consistent assumptions are made, both the acoustic analogy and Tam and Auriault's model yield identical noise predictions. The paper concludes with a proposal for an acoustic analogy that provides a clearer identification of the equivalent source mechanisms and a discussion of noise prediction issues that remain to be resolved.

Author

*Jet Aircraft Noise; Numerical Analysis; Analogies; K-Epsilon Turbulence Model; Noise Measurement; Noise Prediction (Aircraft)*

**20030015253** Aerospace Corp., Engineering and Technology Group, El Segundo, CA USA

**Sonic Boom Generated by Reentry of Mir**

Moody, D. M.; Sep. 10, 2002; 20p; In English

Report No.(s): AD-A409516; TR-2002(8506)-3; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Russian space station, Mir, was actively deorbited to impact in the South Pacific on 23 March 2001. Mir was the largest body in Earth orbit ever to be deorbited in a controlled fashion. As such, it provided a unique opportunity to observe, at a known time and location, what happens to such a large object as it re-enters the earth's atmosphere. The reentry and breakup were videotaped from the Fiji Sheraton hotel by a CNN cameraman. About four to five minutes after the streaking Mir debris left his view, he described hearing a number of sonic booms which were generated by pieces of the wreckage. This report contains the camera-man's description of what he heard and a calculation of the sonic boom amplitude and duration which would have been generated by a single Mir module on its reentry trajectory. Results of the calculation are consistent with the reported estimated

time of boom arrival past visual sighting. However, no actual measurements were made at the hotel of the boom strength (sound level.) Thus the code results for boom amplitude cannot be quantitatively verified.

DTIC

*Reentry Vehicles; Reentry Trajectories; Sonic Booms*

**20030015483** NASA Langley Research Center, Hampton, VA USA

**Acoustic Aspects of Active-Twist Rotor Control**

Booth, Earl R., Jr., NASA Langley Research Center, USA; Wilbur, Matthew L., Army Research Lab., USA; [2002]; 15p; In English; American Helicopter Society 58th Annual Forum, 11-13 Jun. 2002, Montreal, Canada; Sponsored by American Helicopter Society, Inc., USA; Original contains color illustrations; Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche; Distribution under U.S. Government purpose rights; Distribution under U.S. Government purpose rights

The use of an Active Twist Rotor system to provide both vibration reduction and performance enhancement has been explored in recent analytical and experimental studies. Effects of active-twist control on rotor noise, however, had not been determined. During a recent wind tunnel test of an active-twist rotor system, a set of acoustic measurements were obtained to assess the effects of active-twist control on noise produced by the rotor, especially blade-vortex interaction (BVI) noise. It was found that for rotor operating conditions where BVI noise is dominant, active-twist control provided a reduction in BVI noise level. This BVI noise reduction was almost, but not quite, as large as that obtained in a similar test using HHC. However, vibration levels were usually adversely affected at operating conditions favoring minimum BVI noise. Conversely, operating conditions favoring minimum vibration levels affected BVI noise levels, but not always adversely.

Author

*Rotor Aerodynamics; Aeroacoustics; Rotors; Noise Reduction; Wind Tunnel Tests; Active Control; Blade Slap Noise*

**20030015691** Virginia Polytechnic Inst. and State Univ., Dept. of Mechanical Engineering, Blacksburg, VA USA

**Fan Noise Control Using Herschel-Quincke Resonators *Interim Report, Jan. - Sep. 2002***

Burdisso, Ricardo A., Virginia Polytechnic Inst. and State Univ., USA; Ng, Wing F., Virginia Polytechnic Inst. and State Univ., USA; January 2003; 22p; In English; Original contains color illustrations

Contract(s)/Grant(s): NAG3-2694; RTOP 708-87-23

Report No.(s): NASA/CR-2003-212097; NAS 1.26:212097; E-13750; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The research effort proposed for this NASA NRA is mainly experimental. In addition, Virginia Tech is working in partnership with Goodrich Aerospace, Aerostructures Group for the analytical development needed to support the experimental endeavor, i.e. model development, design, and system studies. In this project, Herschel-Quincke (HQ)liner technology experiments will be performed at the NASA Glenn Active Noise Control Fan (ANCF) facility. A schematic of both inlet and aft HQ-liner systems installed in the ANCF rig as well as a picture of the Glenn facility is shown. The main goal is to simultaneously test in both the inlet and bypass duct sections. The by-pass duct will have HQ-systems in both the inner and outer duct walls. The main advantages of performing tests at the ANCF facility are that the effect of the inlet HQ-system on the by-pass HQ-system and vice versa, can be accurately determined from the in-duct modal data. Another significant advantage is that it offers the opportunity to assess (on a common basis) the proposed noise reduction concept on the ANCF rig which in the past has been used for assessing other active and passive noise reduction strategies.

Derived from text

*Fan Blades; Noise Reduction; Resonators; Active Control; Aeroacoustics; Turbofan Engines*

**20030015778** Alphatech, Inc., Burlington, MA USA

**Multi-Sensor Single Target Bearing-Only Tracking in Clutter**

Mallick, Mahendra; Kirubarajan, T.; Oct. 2001; 18p; In English; Original contains color illustrations; See also ADM201471, Papers from the Meeting of the MSS Specialty Group on Battlefield Acoustic and Seismic Sensing, Magnetic and Electric Field Sensors (2001) Held in Applied Physics Lab, Johns Hopkins Univ, Laurel, MD on 24-26 Oct. 2001

Contract(s)/Grant(s): F49620-98-C-0010

Report No.(s): AD-A409363; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

In this paper, we have addressed the single target multiple acoustic UGS tracking in clutter using the particle filter (PF) algorithm. We have used realistic values for the probability of detection and false alarm. We have demonstrated that the PF algorithm works in a robust manner when the probability of detection is low and the false alarm is high as is the case in realistic

harsh scenarios. In our future work, we plan to compare the performance of the PF with the EKF using the PDA approach and analyze the estimation accuracy by varying the accuracy of the acoustic sensor measurement.

DTIC

*Tracking (Position); Sound Detecting and Ranging; Sensors*

**20030015850** Army Research Lab., Sensors Directorate, Adelphi, MD USA

**Algorithms for Localization and Tracking of Acoustic Sources with Widely Separated Sensors**

Kozick, Richard J.; Sadler, Brian M.; Sep. 23, 2000; 20p; In English; Original contains color illustrations, all DTIC reproductions will be in black and white; See also ADM201471, Papers from the Meeting of the MSS Specialty Group on Battlefield Acoustic and Seismic Sensing, Magnetic and Electric Field Sensors (2001) Held in Applied Physics Lab, Johns Hopkins Univ, Laurel, MD on 24-26 Oct. 2001, volume 2.

Report No.(s): AD-A409537; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Multiple sensor arrays distributed over a region provide the means for accurate localization of the (x, y) position of a source. When microphone arrays are used to measure aeroacoustic signals from ground vehicles, random fluctuations in the air lead to frequency-selective coherence of the signals that arrive at widely-separated arrays. We have shown previously that even in cases of imperfect spatial coherence, improvements in source localization accuracy are possible when the data from widely-separated arrays are processed jointly by a fusion center. Further, we have shown that a distributed processing scheme involving bearing estimation at individual arrays and time-delay estimation between pairs of widely-separated sensors performs nearly as well as the optimum scheme, with significantly lower communication bandwidth. These results were obtained by studying the Cramer-Rao bound (CRB) on source localization accuracy based on a statistical model for the data measured at the sensors. The contributions of this paper include the presentation of more accurate performance bounds (Ziv-Zakai), and the development of a narrowband subspace algorithm for source localization with distributed arrays and partially coherent signals. We demonstrate through analysis, simulation, and processing of measured data that the performance of both algorithms is limited by ambiguities that arise from the narrowband signals and the large spacing between arrays.

DTIC

*Mathematical Models; Algorithms; Statistical Analysis; Aeroacoustics; Position (Location)*

**20030016091** Defence Science and Technology Organisation, Information Sciences Lab., Edinburgh, Australia

**The Effects of Background Noise on the Performance of an Automatic Speech Recogniser**

Littlefield, Jason, Defence Science and Technology Organisation, Australia; HashemiSakhtsari, Ahmad, Defence Science and Technology Organisation, Australia; November 2002; 35p; In English

Report No.(s): DSTO-RR-0248; DODA-AR-012-500; Copyright; Avail: Issuing Activity

Ambient or environmental noise is a major factor that affects the performance of an automatic speech recognizer. Large vocabulary, speaker-dependent, continuous speech recognizers are commercially available. Speech recognizers, perform well in a quiet environment, but poorly in a noisy environment. Speaker-dependent speech recognizers require training prior to them being tested, where the level of background noise in both phases affects the performance of the recognizer. This study aims to determine whether the best performance of a speech recognizer occurs when the levels of background noise during the training and test phases are the same, and how the performance is affected when the levels of background noise during the training and test phases are different. The relationship between the performance of the speech recognizer and upgrading the computer speed and amount of memory as well as software version was also investigated.

Author

*Background Noise; Performance; Speech Recognition; Audio Equipment*

**20030016691** Ohio Aerospace Inst., Brook Park, OH USA

**On the Applicability of High-Frequency Approximations to Lilley's Equation Final Report**

Wundrow, David W., Ohio Aerospace Inst., USA; Khavaran, Abbas, QSS Group, Inc., USA; January 2003; 36p; In English

Contract(s)/Grant(s): GESS-005; RTOP 708-87-25

Report No.(s): NASA/CR-2003-212089; NAS 1.26:212089; E-13742; Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche; Distribution as joint owner in the copyright under contract GESS-005; Distribution as joint owner in the copyright under contract GESS-005

Three forms of the high-frequency asymptotic Green's function for Lilley's equation are reviewed and compared to the exact solution over wide range of Strouhal numbers. The asymmetric approximation, which applies to sources away from the jet axis, and the quasi-symmetric approximation, which is arrived at by making a near-axis source assumption, are both obtained for parallel round jets from a formal Fourier-transform solution. The ray-theory solution, which is the only high-frequency

approximation that can be applied to more general mean flows, follows from a WKB ansatz and is shown to be closely related to the asymmetric approximation. The comparisons show that the best overall prediction of the exact Green's function is given by the asymmetric approximation which remains accurate down to a Strouhal number of 1/2. The close relationship between the asymmetric and ray-theory approximations suggests that the high-frequency asymptotic Green's function for more general mean flows would be similarly successful.

Author

*Green'S Functions; Aeroacoustics; Jet Mixing Flow; Geometrical Acoustics; Noise Prediction (Aircraft); Asymptotic Methods; Approximation*

**20030017840** NASA Glenn Research Center, Cleveland, OH USA

**Nonlinear Resonant Oscillations of Gas in Optimized Acoustical Resonators and the Effect of Central Blockage**

Li, Xiaofan, Illinois Inst. of Tech., USA; Finkbeiner, Joshua, Illinois Inst. of Tech., USA; Raman, Ganesh, Illinois Inst. of Tech., USA; Daniels, Christopher, Ohio Aerospace Inst., USA; Steinetz, Bruce M., NASA Glenn Research Center, USA; February 2003; 15p; In English; 41st Aerospace Science Meeting and Exhibit, 6-9 Jan. 2003, Reno, NV, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Contract(s)/Grant(s): RTOP 708-28-15

Report No.(s): NASA/TM-2003-212019; NAS 1.15:212019; E-13723; AIAA Paper 2003-0368; Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche; Distribution as joint owner in the copyright; Distribution as joint owner in the copyright

Optimizing resonator shapes for maximizing the ratio of maximum to minimum gas pressure at an end of the resonator is investigated numerically. It is well known that the resonant frequencies and the nonlinear standing waveform in an acoustical resonator strongly depend on the resonator geometry. A quasi-Newton type scheme was used to find optimized axisymmetric resonator shapes achieving the maximum pressure compression ratio with an acceleration of constant amplitude. The acoustical field was solved using a one-dimensional model, and the resonance frequency shift and hysteresis effects were obtained through an automation scheme based on continuation method. Results are presented for optimizing three types of geometry: a cone, a horn-cone and a half cosine-shape. For each type, different optimized shapes were found when starting with different initial guesses. Further, the one-dimensional model was modified to study the effect of an axisymmetric central blockage on the nonlinear standing wave.

Author

*Gas Pressure; Mathematical Models; Nonlinearity; Resonant Frequencies; Acoustics; Oscillations*

## 72

### ATOMIC AND MOLECULAR PHYSICS

*Includes atomic and molecular structure, electron properties, and atomic and molecular spectra. For elementary particle physics see 73 Nuclear Physics.*

**20030015721** NASA Ames Research Center, Moffett Field, CA USA

**Comparison of the T(sub 1) and D(sub 1) Diagnostics: A New Definition for the Open-Shell D(sub 1) Diagnostic**

Lee, Timothy J., NASA Ames Research Center, USA; [2002]; 4p; In English

Contract(s)/Grant(s): RTOP 713-74-10; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

It is shown that the T(sub 1) operator used in a previous study to define the open-shell D(sub 1) diagnostic is invalid, and leads to an arbitrary definition of the open-shell D(sub 1) diagnostic. A new definition is proposed that eliminates this ambiguity and approximately restores the mathematical relationship previously noted between the closed-shell D(sub 1) and T(sub 1) diagnostics. Statistical comparison of the T(sub 1) and D(sub 1) diagnostics shows a very high degree of correlation between them, although it is argued that both diagnostics used together can provide more information than either can separately.

Author

*Diagnosis; Electrons; Electron Orbitals*

**20030016578** Argonne National Lab., IL USA

**Non-Additive Sputtering of Niobium and Tantalum as Neutral and Charged Clusters**

Belykh, S. F.; Palitsin, V. V.; Veryovkin, I. V.; Adrianes, A.; Adams, F.; 2002; 20p; In English

Report No.(s): DE2002-801620; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

An analysis of available literature data on both the positive ion emission from Nb and Ta bombarded by 6 keV/atom Au(sup -)(sub m) atomic and molecular ions (m=1, 2, 3) and positive ionization probabilities of Nb (sub n) and Ta (sub n) neutral clusters

sputtered from the same metals by 5 keV Ar<sup>+</sup> ions have been conducted. Dependencies of cluster yields  $Y_{(n, m)}$  (regardless of a charge state) on number of atoms  $n$  in a sputtered particle were found to follow a power law as  $Y_{(n, m)} \approx n^{\Delta m}$  where  $\Delta m$  decreased with an increase of  $m$ . A non-linear enhancement of yields for large  $Nb_{(n)}^{+}$  and  $Tan^{+}$  cluster ions ( $n$  greater than 4) appeared to be due to a non-additive process of sputtering rather than because of a non-additive process of their ionization. A manifestation of the non-additive sputtering in kinetic energy distributions of secondary ions found to be different for atomic and cluster ions.

NTIS

*Ionization; Atomic Clusters; Charged Particles; Ion Emission; Positive Ions; Probability Theory; Sputtering*

**20030017984** NASA Ames Research Center, Moffett Field, CA USA

**New Ro-Vibrational Kinetic Energy Operators using Polyspherical Coordinates for Polyatomic Molecules**

Schwenke, David W., NASA Ames Research Center, USA; Dec. 20, 2002; 19p; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We illustrate how one can easily derive kinetic energy operators for polyatomic molecules using polyspherical coordinates with very general choices for z-axis embeddings and angles used to specify relative orientations of internal vectors. Computer algebra is not required.

Author

*Kinetic Energy; Polyatomic Molecules; Vibration; Coordinates; Vectors (Mathematics)*

## 73

### NUCLEAR PHYSICS

*Includes nuclear particles; and reactor theory. For space radiation see 93 Space Radiation. For atomic and molecular physics see 72 Atomic and Molecular Physics. For elementary particle physics see 77 Physics of Elementary Particles and Fields. For nuclear astrophysics see 90 Astrophysics.*

**20030016554** Lawrence Livermore National Lab., Livermore, CA USA

**Results of the Recirculator Project at LLNL**

Ahle, L.; Sangster, T. C.; Barnard, J.; Burkhart, C.; Craig, G.; Mar. 2000; 24p; In English

Report No.(s): DE2002-792497; UCRL-JC-136240; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The Heavy Ion Fusion Group at Lawrence Livermore National Laboratory has for several years been developing the world's first circular induction accelerator designed for space charge dominated ion beams. Experiments on one quarter of the ring have been completed. The accelerator extended ten half-lattice periods (HLP) with induction cores for acceleration placed on every other HLP. A network of Capacitive Beam Probes (C-probes) was also enabled for beam position monitoring throughout the bend section. These C-probes have been instrumental in steering experiment, implementation of the acceleration stages and the dipole pulser, and the first attempts at coordinated bending and acceleration. Data from these experiments and emittance measurements will be presented.

NTIS

*Accelerators; Beams (Radiation); Emittance*

**20030017763** Lawrence Livermore National Lab., Livermore, CA USA

**Validity of a Paraxial Approximation in the Simulation of Laser-Plasma Interactions**

Hyde, E. M.; Jul. 26, 2000; In English; This document is color dependent and/or in landscape layout. It is currently only available on CD-ROM

Report No.(s): DE2002-792821; UCRL-JC-139805; No Copyright; Avail: National Technical Information Service (NTIS)

The design of high-power lasers such as those used for inertial confinement fusion demands accurate modeling of the interaction between lasers and plasmas. In inertial confinement fusion, initial laser pulses ablate material from the hohlraum, which contains the target, creating a plasma. Plasma density variations due to plasma motion, ablating material and the ponderomotive force exerted by the laser on the plasma disrupt smooth laser propagation, undesirably focusing and scattering the light. Accurate and efficient computational simulations aid immensely in developing an understanding of these effects. In this paper, we compare the accuracy of two methods for calculating the propagation of laser light through plasmas.

NTIS

*Lasers; Inertial Confinement Fusion; Plasmas (Physics); Laser Plasma Interactions; Simulation; Approximation*

74  
OPTICS

*Includes light phenomena and the theory of optical devices. For lasers see 36 Lasers and Masers.*

**20030014733** NASA Langley Research Center, Hampton, VA USA

**Field-Sensitive Materials for Optical Applications**

Choi, Sang H., NASA Langley Research Center, USA; Little, Mark, Institute for Computer Applications in Science and Engineering, USA; [2002]; 5p; In English; AIAA NanoTech, 9-12 Sep. 2002, Houston, TX, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA; Original contains color illustrations

Report No.(s): AIAA Paper 2002-5747; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The purpose of investigation is to develop the fundamental materials and fabrication technology for field-controlled spectrally active optics that are essential for industry, NASA, and DOD (Department of Defense) applications such as: membrane optics, filters for LIDARs (Light Detection and Ranging), windows for sensors and probes, telescopes, spectroscopes, cameras, light valves, light switches, flat-panel displays, etc. The proposed idea is based on the quantum-dots (QD) array or thin-film of field-sensitive Stark and Zeeman materials and the bound excitonic state of organic crystals that will offer optical adaptability and reconfigurability. Major tasks are the development of concept demonstration article and test data of field-controlled spectrally smart active optics (FCSAO) for optical multi-functional capabilities on a selected spectral range.

Author

*Optical Materials; Quantum Dots; Thin Films; Electric Fields; Sensitivity*

**20030014792** Hampton Univ., VA USA

**Optical Electronic Bragg Reflection Sensor System with Hydrodynamic Flow Applications Final Report, 31 May 1998 - 30 May 2002**

Lyons, D. R., Hampton Univ., USA; [2003]; 8p; In English

Contract(s)/Grant(s): NAG3-2189; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

This project, as described in the following report, involved design and fabrication of fiber optic sensors for the detection and measurement of dynamic fluid density variations. These devices are created using UV (ultraviolet) ablation and generally modified transverse holographic fiber grating techniques. The resulting phase gratings created on or immediately underneath the flat portion of D-shaped optical waveguides are characterized as evanescent field sensing devices. The primary applications include the sensor portion of a real-time localized or distributed measurement system for hydrodynamic flow, fluid density measurements, and phase change phenomena. Several design modifications were implemented in an attempt to accomplish the tasks specified in our original proposal. In addition, we have established key collaborative relationships with numerous people and institutions.

Derived from text

*Bragg Reflectors; Fiber Optics; Sensors; Hydrodynamics*

**20030015239** California Inst. of Tech., Submillimeter Observatory, Pasadena, CA USA

**A Full-Height Waveguide to Thin-Film Microstrip Transition with Exceptional RF Bandwidth and Coupling Efficiency**

Kooi, J. W., California Inst. of Tech., USA; Chattopadhyay, G., California Inst. of Tech., USA; Withington, S., Cambridge Univ., UK; Rice, F., California Inst. of Tech., USA; Zmuidzinas, J., California Inst. of Tech., USA; Walker, C., Arizona Univ., USA; Yassin, G., Cambridge Univ., UK; [2003]; 18p; In English

Contract(s)/Grant(s): NSF AST-99-80846

Report No.(s): Rept-2003-2; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We describe a waveguide to thin-film microstrip transition for high-performance submillimetre wave and terahertz applications. The proposed constant-radius probe couples thin-film microstrip line, to full-height rectangular waveguide with better than 99% efficiency (VSWR less than or equal to 1.20) and 45% fractional bandwidth. Extensive HFSS simulations, backed by scale-model measurements, are presented in the paper. By selecting the substrate material and probe radius, any real impedance between approx. 15-60 ohms can be achieved. The radial probe gives significantly improved performance over other designs discussed in the literature. Although our primary application is submillimetre wave superconducting mixers, we show that membrane techniques should allow broad-band waveguide components to be constructed for the THz frequency range.

Author

*Rectangular Waveguides; Thin Films; Microstrip Transmission Lines; Submillimeter Waves; Simulation; Scale Models*

**20030015419** Illinois Univ. at Urbana-Champaign, Dept. of Electrical and Computer Engineering, Urbana, IL USA

**Generalized Series Imaging with Multiple References**

Liang, Zhi-Pei; Oct. 25, 2001; 5p; In English

Report No.(s): AD-A409458; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Many imaging applications require the acquisition of a time series of images. In conventional Fourier transform-based imaging methods, each of these images is acquired independently. As a result, one often has to sacrifice spatial resolution for temporal resolution. To address this problem, this paper extends a generalized series imaging method so that multiple references can be used to achieve high spatiotemporal resolution. Application results are also presented to illustrate its effectiveness for high-resolution dynamic imaging.

DTIC

*Fourier Transformation; Image Processing; Magnetic Resonance; Imaging Techniques*

**20030015782** Air Force Research Lab., Propulsion Directorate West, Edwards AFB, CA USA

**Phase Doppler Interferometry with Probe-to-Droplet Size Ratios Less Than Unity, Part 1, Trajectory Errors**

Strakey, P. A.; Talley, D. G.; Sankar, S. V.; Bachalo, W. D.; Aug. 16, 1999; 20p; In English; Prepared in collaboration with Consultants, Los Altos Hills, CA. See Also ADA409372

Contract(s)/Grant(s): AF Proj. 2308

Report No.(s): AD-A409371; AFRL-PR-ED-TP-FY99-0163-Pt-1; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Phase Doppler interferometry utilizing a probe volume much smaller than the droplets being measured has been shown to work well when coupled with a phase ratio and intensity validation scheme which is capable of eliminating trajectory dependent scattering errors. Ray-tracing and geometric optics models were used to quantitatively demonstrate the type and magnitude of trajectory errors through stochastic trajectory calculations. Measurements with mono-dispersed water droplet streams and glass beads have been performed to validate the model calculations. Measurements with mono-dispersed water droplet streams and glass beads have been performed to validate the model calculations and to characterize the probe volume. Scattered light intensity has also been shown to provide a robust means of determining the probe cross-sectional area which is critical for making accurate mass flux measurements.

DTIC

*Interferometry; Drops (Liquids); Doppler Effect; Particles; Size Determination*

**20030015783** Air Force Research Lab., Propulsion Directorate West, Edwards AFB, CA USA

**Phase Doppler Interferometry with Probe-to-Droplet Size Ratios Less Than Unity, Part 2, Application of the Technique**

Strakey, P. A.; Talley, D. G.; Sankar, S. V.; Bachalo, W. D.; Aug. 16, 1999; 12p; In English

Contract(s)/Grant(s): AF Proj. 2308

Report No.(s): AD-A409372; AFRL-PR-ED-TP-FY99-0163-Pt-2; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Practical limitations associated with the use of small probe volumes for measuring large droplets with the phase Doppler interferometry technique are discussed. An intensity validation scheme and corresponding probe volume correction factor have been developed that reject trajectory errors and account for the rejections in calculation of the probe cross-sectional area. The intensity validation scheme also provides a tractable method of setting the photomultiplier tube gain and laser power. Volume flux measurements in dilute sprays have shown a significant improvement over standard phase Doppler interferometry techniques at small beam waist to droplet size ratios.

DTIC

*Interferometry; Drops (Liquids); Doppler Effect; Particles; Size Determination*

**20030015807** Argonne National Lab., IL USA

**Double K-Vacancy Production by X-Ray Photoionization**

2002; In English; This document is color dependent and/or in landscape layout. It is currently available on CD-ROM

Report No.(s): DE2002-799803; No Copyright; Avail: National Technical Information Service (NTIS)

No abstract available.

NTIS

*Photoionization; X Rays*

**20030016703** Lawrence Livermore National Lab., Livermore, CA USA

**Low-Noise Semiconductor Optical Amplifier**

Ratowsky, R. P.; Dijaili, S.; Kallman, J. S.; Feit, M. D.; Walker, J.; Mar. 23, 1999; 14p; In English

Report No.(s): DE2002-792781; UCRL-ID-133538; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Optical amplifiers are essential devices for optical networks, optical systems, and computer communications. Fiber amplifiers such as the erbium-doped fiber amplifier have revolutionized the fiber-optics industry and are enjoying widespread use. Semiconductor optical amplifiers (SOAs) are an alternative technology that complements the fiber amplifiers in cost and performance.

NTIS

*Light Amplifiers; Semiconductors (Materials); Low Noise; Doped Crystals*

**20030017804** National Oceanic and Atmospheric Administration, Climate Diagnostics Center, Boulder, CO USA

**Monthly Variability of ENSO Signals and the Relevance for Monthly Predictions**

Hoerling, Martin P., National Oceanic and Atmospheric Administration, USA; Prospects for Improved Forecasts of Weather and Short-Term Climate Variability on Subseasonal (2-Week to 2-Month) Times Scales; November 2002; Volume 23, pp. 122; In English; Also announced as 20030017775; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The role of ENSO in the predictability of monthly averages (monthly prediction) is explored. The simplest approach, and one commonly used, is to specify the seasonal mean atmospheric signal related to ENSO. An effective "monthly resolution" to such signals is rendered by calculating overlapping, seasonal averages. Yet, these could underestimate true monthly ENSO-related predictability to the extent that distinct monthly signals exist, and vary within a season. It is well established that the potentially predictable ENSO signal varies from one season to another, and it is thus reasonable to expect that some variation occurs even within a season. This could occur due to a strong sensitivity of tropical-extratropical interactions to modest changes in the atmospheric base state. It could also be due to sub-seasonal changes in the tropical forcing accompanying the ENSO cycle itself. The focus of this study is to provide evidence for the existence of sub-seasonal variations in the ENSO signal, and the analysis uses NSIPP climate simulations and observed data for 1950-2000. Results are presented for the late boreal Fall season (October-November-December, OND), during which the seasonal mean 500-mb ENSO signal is compared to the individual monthly signals. Distinct atmospheric signals occur in each month. A striking feature of the sub-seasonal variation in the ENSO signal is that the October and December responses over the Pacific-North American region are anti-correlated, and as such the associated seasonal mean signal is a smeared residual of sharper patterns. The practical importance for monthly predictions is discussed within a "signal-to-noise ratio" framework for predictability assessment.

Author

*Month; El Nino; Southern Oscillation; Climate; Annual Variations*

**20030017805** Reading Univ., UK

**The Influence of El Nino on the Circulation Over the North Pacific and North America**

Spencer, Hilary, Reading Univ., UK; Slingo, Julia M., Reading Univ., UK; Prospects for Improved Forecasts of Weather and Short-Term Climate Variability on Subseasonal (2-Week to 2-Month) Times Scales; November 2002; Volume 23, pp. 123-127; In English; Also announced as 20030017775; Original contains color illustrations; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

Simulating ENSO teleconnections with an atmospheric GCM (AGCM) is normally considered to be of interest to seasonal forecasting. A long AGCM ensemble with observed SSTs is studied and shows that there are significant systematic errors of seasonal means over the North Pacific during the peak of El Nino in DJF and after the peak in MAM. It has been shown by other contributors that improved sub-seasonal forecasting (2 weeks to 2 months) requires reduced systematic model errors. Therefore, reducing the sources of the seasonal mean systematic error should be beneficial to shorter timescales. It is shown that these systematic errors can be dramatically reduced with a small increase in the vertical model resolution.

Author

*El Nino; Forecasting; Southern Oscillation; Teleconnections (Meteorology); Circulation Distribution*

**20030017837** NASA Glenn Research Center, Cleveland, OH USA

**Diffraction Efficiency of Thin Film Holographic Beam Steering Devices**

Titus, Charles M., Kent State Univ., USA; Pouch, John, NASA Glenn Research Center, USA; Nguyen, Hung, NASA Glenn Research Center, USA; Miranda, Felix, NASA Glenn Research Center, USA; Bos, Philip J., Kent State Univ., USA; February 2003; 20p; In English; 47th Annual Meeting, International Symposium on Optical Science and Technology, 7-11 Jul. 2002,

Seattle, WA, USA; Sponsored by International Society for Optical Engineering, USA; Original contains color illustrations  
Contract(s)/Grant(s): RTOP 757-01-04

Report No.(s): NASA/TM-2003-211806; NAS 1.15:211806; E-13501; Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche; Distribution as joint owner in the copyright; Distribution as joint owner in the copyright

Dynamic holography has been demonstrated as a method for correcting aberrations in space deployable optics, and can also be used to achieve high-resolution beam steering in the same environment. In this paper, we consider some of the factors affecting the efficiency of these devices. Specifically, the effect on the efficiency of a highly collimated beam from the number of discrete phase steps per period is considered for a blazed thin film beam steering grating. The effect of the number of discrete phase steps per period on steering resolution is also considered. We also present some result of Finite-Difference Time-Domain (FDTD) calculations of light propagating through liquid crystal "blazed" gratings. Liquid crystal gratings are shown to spatially modulate both the phase and amplitude of the propagating light.

Author

*Beam Steering; Holography; Thin Films; Liquid Crystals; Gratings (Spectra); Light Modulators*

**20030017841** NASA Glenn Research Center, Cleveland, OH USA

### **The Light Microscopy Module Design and Performance Demonstrations**

Motil, Susan M., NASA Glenn Research Center, USA; Snead, John H., NASA Glenn Research Center, USA; Griffin, DeVon W., NASA Glenn Research Center, USA; Hovenac, Edward A., Northrop Grumman Information Technology, Inc., USA; January 2003; 16p; In English; 41st Aerospace Sciences Meeting and Exhibit, 6-9 Jan. 2003, Reno, NV, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA; Original contains color illustrations

Contract(s)/Grant(s): RTOP 400-32-30-03

Report No.(s): NASA/TM-2003-212112; E-13755; NAS 1.15:212112; AIAA Paper 2003-1303; Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche; Distribution as joint owner in the copyright; Distribution as joint owner in the copyright

The Light Microscopy Module (LMM) is a state-of-the-art space station payload to provide investigations in the fields of fluids, condensed matter physics, and biological sciences. The LMM hardware will reside inside the Fluids Integrated Rack (FIR), a multi-user facility class payload that will provide fundamental services for the LMM and future payloads. LMM and FIR will be launched in 2005 and both will reside in the Destiny module of the International Space Station (ISS). There are five experiments to be performed within the LMM. This paper will provide a description of the initial five experiments: the supporting FIR subsystems; LMM design; capabilities and key features; and a summary of performance demonstrations.

Author

*Spectrophotometry; Light (Visible Radiation); Optical Microscopes; Spaceborne Experiments; Space Station Payloads*

## 75

### PLASMA PHYSICS

*Includes magnetohydrodynamics and plasma fusion. For ionospheric plasmas see 46 Geophysics. For space plasmas see 90 Astrophysics.*

**20030015491** NASA Glenn Research Center, Cleveland, OH USA

### **The Neutral Gas Desorption and Breakdown on a Metal-Dielectric Junction Immersed in Plasma**

Vayner, Boris, NASA Glenn Research Center, USA; Galofaro, Joel, NASA Glenn Research Center, USA; Ferguson, Dale, NASA Glenn Research Center, USA; [2002]; 7p; In English; 33rd AIAA Plasmadynamics and Lasers Conference, 20-23 May 2002, Maui, HI, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Contract(s)/Grant(s): RTOP 755-A4-05; Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche; Distribution as joint owner in the copyright; Distribution as joint owner in the copyright

New results are presented of an experimental study and theoretical analysis of arcing on metal-dielectric junctions immersed in a low-density plasma. Two samples of conventional solar arrays have been used to investigate the effects of arcing within a wide range of neutral gas pressures, ion currents, and electron number densities. All data (except video) were obtained in digital form that allowed us to study the correlation between external parameters (plasma density, additional capacitance, bias voltage, etc) and arc characteristics (arc rate, arc current pulse width and amplitude, gas species partial pressures, intensities of spectral lines, and so on). Arc sites were determined by employing a video-camera, and it is shown that the most probable sites for arc inception are trip le-junctions, even though some arcs were initiated in gaps between cells. The effect of surface conditioning (decrease of arc rate due to outgassing) was clearly demonstrated. Moreover, a considerable increase in arc rate due to absorption of molecules from atmospheric air has been confirmed. The analysis of optical spectra (240-800 nm) reveals intense narrow atomic

lines (Ag, H) and wide molecular bands (OH, CH, SiH, SiN) that confirm a complicated mechanism of arc plasma generation. The rate of plasma contamination due to arcing was measured by employing a mass-spectrometer. These measurements provided quite reliable data for the development of a theoretical model of plasma contamination. In conclusion, the arc threshold was increased to above 350 V (from 190 V) by keeping a sample in vacuum (20 micronTorr) for seven days. The results obtained are important for the understanding of the arc inception mechanism, which is absolutely essential for progress toward the design of high voltage solar arrays for space applications.

Author

*Atomic Spectra; Dielectrics; Gas Dissociation; Numerical Analysis; Experimentation; Plasmas (Physics); Metal Joints; Joints (Junctions)*

**20030015748** California Univ., Lawrence Berkeley National Lab., Berkeley, CA USA

**Mesh Refinement for Particle-In-Cell Plasma Simulations: Applications to - and Benefits for - Heavy-Ion-Fusion**

Vay, J. L.; Colella, P.; McCorquodale, P.; Friedman, A.; 2002; In English; This document is color dependent and/or in landscape layout. It is currently available on CD-ROM

Report No.(s): DE2002-799648; No Copyright; Avail: National Technical Information Service (NTIS)

No abstract available.

NTIS

*Mesh; Plasmas (Physics)*

**20030015845** Ohio State Univ., Dept. of Mechanical Engineering, Columbus, OH USA

**Plasma Ramparts Using Metastable Molecules Final Report, 1 May 1997-30 Apr. 2002**

Rich, Joseph W.; Miles, Richard B.; Oct. 01, 2002; 383p; In English; Prepared in cooperation with Princeton University, Dept. of Mech. and Aerospace Eng., Princeton, NJ

Contract(s)/Grant(s): F49620-97-1-0312

Report No.(s): AD-A409530; AFRL-SR-AR-TR-02-0392; No Copyright; Avail: CASI; A17, Hardcopy; A03, Microfiche

The main goals of this experimental and theoretical project were to demonstrate the ability to create a uniform and diffuse nonequilibrium air plasma at atmospheric pressure, with an electron density of  $10^{13}$  cm<sup>-3</sup>, a temperature below 2000 K, scalable to cubic meter size, with a low power budget. The Ohio State Consortium was focusing on use of efficient ionization sources, specifically e-beams and short pulse ionization wave generators, and on mitigation of electron removal by using laser energy addition to excite the vibrational modes of the air species. By this means, the power budget to sustain a stable plasma in low temperature, atmospheric pressure air is significantly reduced. The plasma decay time has been increased by more than two orders of magnitude. In addition, there have been major efforts to investigate the relevant ionization, electron removal, and energy transfer processes in such air plasmas, to model and analyze both e-beam and short pulse ionization sources in large volume air plasmas, to develop short pulse ionization wave generators, and to develop and employ advanced diagnostic methods to characterize the air plasmas produced. There have been major positive and novel results achieved in each of these areas.

DTIC

*Atmospheric Pressure; Plasmas (Physics); Nonequilibrium Plasmas; Plasma Temperature*

**20030016541** Lawrence Livermore National Lab., Livermore, CA USA

**Plasma Focusing of High Energy Density Electron and Positron Beams**

Ng, J. S. T.; Baldis, H. A.; Bolton, P.; Chen, P.; Cline, D.; Aug. 11, 2000; 18p; In English

Report No.(s): DE2002-792823; UCRL-JC-139670; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

We present results from the SLAC E-150 experiment on plasma focusing of high energy density electron and, for the first time, positron beams. We also present results on plasma lens-induced synchrotron radiation, longitudinal dynamics of plasma focusing, and laser- and beam-plasma interactions.

NTIS

*Electromagnetic Interactions; Electron Beams; Energy Transfer; Positrons; Plasma Heating*

**20030016704** Lawrence Livermore National Lab., Livermore, CA USA

**Algorithm for Wave-Particle Resonances in Fluid Codes-Final Report**

Mattor, N.; Mar. 24, 2000; 24p; In English

Report No.(s): DE2002-792770; UCRL-ID-138116; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

We review the work performed under LDRD ER grant 9%ERD-099. The goal of this work is to write a subroutine for a fluid turbulence code that allows it to incorporate wave-particle resonances (WPR). WPR historically have required a kinetic code, with

extra dimensions needed to evolve the phase space distribution function,  $f(2, ZJ, I)$ . The main results accomplished under this grant have been: (1) Derivation of a nonlinear closure term for 1D electrostatic collisionless fluid (2) Writing of a 1D electrostatic fluid code, 'eslf,' with a subroutine to calculate the aforementioned closure term (3) derivation of several methods to calculate the closure term, including Eulerian, Euler-local, fully local, linearized, and linearized zero-phase-velocity, and implementation of these in eslf, (4) Successful modeling of the Landau damping of an arbitrary Langmuir wave, (5) Successful description of a kinetic two-stream instability up to the point of the first bounce, and (6) a spin-off project which uses a mathematical technique developed for the closure, known as the Phase Velocity Transform (PVT) to decompose turbulent fluctuations.

NTIS

*Algorithms; Particles; Landau Damping; Electrostatics; Phase Velocity*

**20030017744** California Univ., Lawrence Berkeley National Lab., Berkeley, CA USA

**Hot Electron Diagnostic in a Solid Laser Target by K-Shell Lines Measurement from Ultra-Intense Laser-Plasma Interactions (Lambda=1.06 micrometer,  $3 \times 10^{20}$  W/sq cm, less than or equal to 500 J)**

Yasuike, K.; Wharton, K. B.; Key, M. H.; Hatchett, S. P.; Snavely, R. A.; Jul. 27, 2000; 46p; In English

Report No.(s): DE2002-802096; UCRL-ID-139812; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Characterization of hot electron production (a conversion efficiency from laser energy into electrons) from ultra intense laser-solid target interaction by observing molybdenum (Mo) K $\beta$  as well as K-alpha emissions from a buried fluorescence tracer layer in the targets has been done. The experiments used 1.06 microm laser light with an intensity of from  $2 \times 10^{18}$  up to  $3 \times 10^{20}$  to W /sq cm (20 - 0.5 ps pulse width) and an on target laser energy of 280-500 J. The conversion efficiency from the laser energy into the energy, carried by hot electrons, has been estimated to be approximately 50 % for the 0.5 ps shots at an on-target laser intensity of  $3 \times 10^{20}$  W /sq cm, which increased from approximately 30 % at  $1 \times 10^{19}$  W /sq cm 5 ps shots and approximately 12 % at  $2 \times 10^{18}$  W /sq cm 20 ps shots.

NTIS

*Laser Plasma Interactions; Hot Electrons; Laser Targets; Fluorescence; K Lines; Energy Conversion Efficiency*

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### SOLID-STATE PHYSICS

*Includes condensed matter physics, crystallography, and superconductivity. For related information see also 33 Electronics and Electrical Engineering and 36 Lasers and Masers.*

**20030014725** NASA Glenn Research Center, Cleveland, OH USA

**Basic Equations for the Modeling of Gallium Nitride (GaN) High Electron Mobility Transistors (HEMTs)**

Freeman, Jon C., NASA Glenn Research Center, USA; February 2003; 70p; In English

Contract(s)/Grant(s): RTOP 755-12-27

Report No.(s): NASA/TM-2003-211983; NAS 1.15:211983; E-13653; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Gallium nitride (GaN) is a most promising wide band-gap semiconductor for use in high-power microwave devices. It has functioned at 320 C, and higher values are well within theoretical limits. by combining four devices, 20 W has been developed at X-band. GaN High Electron Mobility Transistors (HEMTs) are unique in that the two-dimensional electron gas (2DEG) is supported not by intentional doping, but instead by polarization charge developed at the interface between the bulk GaN region and the AlGa $\text{N}$  epitaxial layer. The polarization charge is composed of two parts: spontaneous and piezoelectric. This behavior is unlike other semiconductors, and for that reason, no commercially available modeling software exists. The theme of this document is to develop a self-consistent approach to developing the pertinent equations to be solved. A Space Act Agreement, "Effects in AlGa $\text{N}$ /GaN HEMT Semiconductors" with Silvaco Data Systems to implement this approach into their existing software for III-V semiconductors, is in place (summer of 2002).

Author

*Gallium Nitrides; Field Effect Transistors; High Electron Mobility Transistors*

**20030015194** Computer Sciences Corp., Moffett Field, CA USA

**Nanotechnology Based Materials and Devices for Health Care**

Srivastava, Deepaka, Computer Sciences Corp., USA; Cho, K., Stanford Univ., USA; Brenner, Don, North Carolina State Univ., USA; Menon, Madhu, Kentucky Univ., USA; Andriotis, Antonis, Foundation for Research and Technology-Hellas, Iraklion, Greece; Sagman, Uri, CSixty, USA; Dec. 04, 2002; 6p; In English; SASTRA International Conference, 11-12 Jan. 2003,

Thanjavur, India

Contract(s)/Grant(s): DTT559-99-D-00437; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

This viewgraph presentation provides information on trends in NASA nanotechnology research and development, and future biotechnological applications for that nanotechnology. The presentation covers nanoelectronics, nanosensors, and nanomaterials, biomimetics, devices and materials for health care, carbon nanotubes, biosensors for astrobiology, solid-state nanopores for DNA sequencing, and protein nanotubes.

CASI

*Nanotechnology; Trends; Bioinstrumentation; Biomimetics; Research and Development; Nanostructures (Devices); Nanostructure (Characteristics)*

**20030015837** Alabama Univ., Center for Applied Optics, Huntsville, AL USA

**Nanotechnologies in Taiwan Final Report, 9 Sep.-27 Oct. 2002**

Madarasz, Frank L.; Sep. 2002; 27p; In English

Contract(s)/Grant(s): F49620-02-1-0447; AF Proj. 2301

Report No.(s): AD-A409510; AFRL-SR-AR-TR-02-0440; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The purpose of our visit was to promote the Taiwan AFOSR Nanoscience Initiative and encourage white papers for review and consideration of rfp (request for proposal) from the institutions visited. The goal of the Taiwan AFOSR Nanoscience Initiative is to establish cooperative and mutually beneficial scientific interactions with researchers in Taiwan and scientists in AFRL. The primary motivation behind the Initiative is the recognition of the Taiwan government's commitment to establishing Taiwan as world class technical power with a proposed investment of NT\$19.2B into an national nano science technology program. AFOSR would like to take advantage of the fruits of such a program. The program is expected to launch officially in 2003 and continue until 2007.

DTIC

*Nanotechnology; Taiwan; Research and Development*

**20030015863** NASA Johnson Space Center, Houston, TX USA

**Method and Apparatus for Reducing the Vulnerability of Latches to Single Event Upsets**

Shuler, Robert L., Jr., Inventor, NASA Johnson Space Center, USA; Dec. 10, 2002; 29p; In English; Division of US-Patent-Appl-SN-525371, filed 13 Mar. 2000

Patent Info.: Filed 20 Apr. 2001; NASA-Case-MS-C-22953-2; US-Patent-6,492,857; US-Patent-Appl-SN-840684; US-Patent-Appl-SN-525371; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A delay circuit includes a first network having an input and an output node, a second network having an input and an output, the input of the second network being coupled to the output node of the first network. The first network and the second network are configured such that: a glitch at the input to the first network having a length of approximately one-half of a standard glitch time or less does not cause the voltage at the output of the second network to cross a threshold, a glitch at the input to the first network having a length of between approximately one-half and two standard glitch times causes the voltage at the output of the second network to cross the threshold for less than the length of the glitch, and a glitch at the input to the first network having a length of greater than approximately two standard glitch times causes the voltage at the output of the second network to cross the threshold for approximately the time of the glitch. A method reduces the vulnerability of a latch to single event upsets. The latch includes a gate having an input and an output and a feedback path from the output to the input of the gate. The method includes inserting a delay into the feedback path and providing a delay in the gate.

Author

*Delay Circuits; Latches; Single Event Upsets; Vulnerability*

**20030016191** Computer Sciences Corp., Moffett Field, CA USA

**Where is Scattering Important in Nanotransistors?**

Anantram, M. P., NASA Ames Research Center, USA; Svizhenko, Alexei, NASA Ames Research Center, USA; Nov. 07, 2002; 14p; In English; 4th Motorola Workshop on Computational Materials and Electronics, 14-15 Nov. 2002, Unknown

Contract(s)/Grant(s): NAS2-14303; RTOP 519-40-12; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This viewgraph presentation provides information on where scattering is most detrimental to on-current in a transistor nanostructure. It also provides information on series resistance, potential, and current. The presentation includes algorithms and

models for two dimensional (quasi-one dimensional) simulation of nanostructures, and equations for retarded and less-than Green's functions.

CASI

*Scattering; Nanostructures (Devices); Transistors; Nanostructure (Characteristics)*

**20030016550** Norfolk State Univ., Center for Organic Photonic Materials Research, VA USA

**A New Acceptor (N-type) Polyphenylenevinylene Building Block: SF-PPV-I**

Wang, Yiqing, Norfolk State Univ., USA; Fan, Zhen, Norfolk State Univ., USA; Taft, Charles, Norfolk State Univ., USA; Sun, Sam-Shajing, Norfolk State Univ., USA; [2002]; 9p; In English; CD-ROM contains full text document in PDF format  
Contract(s)/Grant(s): F49620-01-0485; NAG3-2289

Report No.(s): NONP-NASA-CD-2002153472; No Copyright; Avail: CASI; C01, CD-ROM; A02, Hardcopy; A01, Microfiche

A new sulfone derivatized acceptor (n-type) polyphenylenevinylene "SF-PPV" with nano meter sizes and functional terminals has been synthesized and characterized. The SF-PPV-I that contains hydrocarbon alkyl-sulfone moieties has a strong photoluminescence in both solution and in solid thin film states. In dichloromethane, the 5-10 nm sized SF-PPV has a maximum emission at about 530 nm with excitation maximum at about 490 nm. UV-VIS shows a absorption peak onsite at about 500 nm. Optical spectroscopy and electrochemical studies revealed that the SF-PPV-I has an LUMO level at about -3.6 eV (relative to vacuum), and an HOMO level at about -6.1 eV. The average size (length) of SF-PPV-I can be controlled on the nano meter scale via synthetic means. The SF-PPV has the potential in developing polymer based supramolecular opto-electronic semiconductor devices.

Author

*Acceptor Materials; Photovoltaic Effect; Sulfones; Polyphenyls; Synthesis (Chemistry); Photoluminescence*

**20030016551** Norfolk State Univ., Center for Materials Research, VA USA

**Synthesis and Characterization of a Novel Block Copolymer Containing Donor and Acceptor Blocks**

Fan, Z., Norfolk State Univ., USA; Wang, Y., Norfolk State Univ., USA; Haliburton, J., Norfolk State Univ., USA; Maaref, S., Norfolk State Univ., USA; Sun, S., Norfolk State Univ., USA; [2001]; 1p; In English; CD-ROM contains full text document in PDF format

Contract(s)/Grant(s): NAG3-2289

Report No.(s): NONP-NASA-CD-2002153469; No Copyright; Avail: CASI; C01, CD-ROM; A01, Hardcopy; A01, Microfiche

Supra-molecular or nano-structured electro-active polymers find their potential applications in developing variety inexpensive and flexible shaped electronic or opto-electronic devices. In the case of organic photovoltaic materials and devices, for instance, Tang demonstrated that photo generated electrons and holes can be effectively separated and stabilized by the interface of a double layered structure containing organic donors (D) and acceptors (A). Since then, variety donor/acceptor multi-layered, blend or copolymer systems have been studied for potential high efficiency organic photovoltaic devices. Block copolymers are well known for their excellent bicontinuous phase separated characteristic. Both morphological pattern and the phase sizes can be easily fine-tuned by the design of each block. We recently presented our preliminary studies of designing and synthesizing controlled-sized donor and acceptor conjugated polymer blocks. In this paper, we present preliminary results of synthesis and characterizations of coupled donor and acceptor block copolymers and some of their electronic and optical properties.

Derived from text

*Acceptor Materials; Block Copolymers; Nanostructures (Devices); Synthesis (Chemistry); Electrical Properties; Optical Properties; Donor Materials*

**20030016575** Argonne National Lab., IL USA

**Practical Superconductor Development for Electrical Power Applications *Quarterly Report***

Jun. 30, 2001; 34p; In English

Report No.(s): DE2002-801659; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

This is a multiyear experimental research program focused on improving relevant material properties of high-Tc superconductors (HTSs) and on development of fabrication methods that can be transferred to industry for production of commercial conductors. The development of teaming relationships through agreements with industrial partners is a key element of the Argonne (ANL) program.

NTIS

*Electric Power; High Temperature Superconductors*

**20030016689** NASA Glenn Research Center, Cleveland, OH USA

**Electronic Components and Circuits for Extreme Temperature Environments**

Patterson, Richard L., NASA Glenn Research Center, USA; Hammoud, Ahmad, QSS Group, Inc., USA; Dickman, John E., NASA Glenn Research Center, USA; Gerber, Scott, ZIN Technologies, Inc., USA; January 2003; 11p; In English; 2003 Aerospace Conference, 8-15 Mar. 2003, Big Sky, MT, USA; Sponsored by Institute of Electrical and Electronics Engineers, USA

Contract(s)/Grant(s): RTOP 297-60-05

Report No.(s): NASA/TM-2003-212079; NAS 1.15:212079; E-13732; Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche; Distribution as joint owner in the copyright; Distribution as joint owner in the copyright

Planetary exploration missions and deep space probes require electrical power management and control systems that are capable of efficient and reliable operation in very low temperature environments. Presently, spacecraft operating in the cold environment of deep space carry a large number of radioisotope heating units in order to maintain the surrounding temperature of the on-board electronics at approximately 20 C. Electronics capable of operation at cryogenic temperatures will not only tolerate the hostile environment of deep space but also reduce system size and weight by eliminating or reducing the radioisotope heating units and their associate structures; thereby reducing system development as well as launch costs. In addition, power electronic circuits designed for operation at low temperatures are expected to result in more efficient systems than those at room temperature. This improvement results from better behavior and tolerance in the electrical and thermal properties of semiconductor and dielectric materials at low temperatures. The Low Temperature Electronics Program at the NASA Glenn Research Center focuses on research and development of electrical components, circuits, and systems suitable for applications in the aerospace environment and deep space exploration missions. Research is being conducted on devices and systems for reliable use down to cryogenic temperatures. Some of the commercial-off-the-shelf as well as developed components that are being characterized include switching devices, resistors, magnetics, and capacitors. Semiconductor devices and integrated circuits including digital-to-analog and analog-to-digital converters, DC/DC converters, operational amplifiers, and oscillators are also being investigated for potential use in low temperature applications. An overview of the NASA Glenn Research Center Low Temperature Electronic Program will be presented in this paper. A description of the low temperature test facilities along with selected data obtained through in-house component and circuit testing will also be discussed. Ongoing research activities that are being performed in collaboration with various organizations will also be presented.

Author

*Aerospace Environments; Cryogenic Temperature; Electrical Properties; Electronic Equipment Tests; Low Temperature Environments; Low Temperature Tests; Thermodynamic Properties*

**20030016701** Argonne National Lab., IL USA

**Grain Rotation as a Mechanism of Grain Growth in Nanocrystalline Materials**

2002; 24p; In English

Report No.(s): DE2002-801569; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Grain-boundary (GB) properties in a polycrystalline system are generally anisotropic; in particular, both the GB energy and mobility depend on the GB misorientation. Moreover, in nanocrystalline materials, in which the grain size is less than 100 nm, grain rotations leading to the coalescence of neighboring grains via elimination of the common GB between them may provide a new mechanism for grain growth. Here we investigate the combined effect of curvature-driven GB migration and grain-rotation grain-coalescence on the kinetics, topology and morphology of grain growth. A stochastic velocity- Monte-Carlo algorithm based on a variational formulation for the dissipated power is implemented. The presence of both growth mechanisms introduces a physical length scale  $R_c$  into the system, enabling the growth process to be characterized by two regimes. If the average grain size is smaller than  $R_c$ , grain growth is dominated by the grain-rotation-coalescence mechanism. by contrast, if the average grain size is greater than  $R_c$ , growth is dominated by curvature-driven GB migration. The values of the growth exponents, different for the two growth regimes and different from a system with isotropic GB properties, are rationalized in terms of the detailed growth mechanism and the continuous change of the fraction of low-angle GBs in the system. An extended von Neumann-Mullins relation based on averaged GB properties is proposed and verified.

NTIS

*Grain Boundaries; Grain Size; Polycrystals*

**20030017773** California Univ., Lawrence Berkeley National Lab., Berkeley, CA USA

**Differences and Similarities Between Structural Properties of GaN Grown by Different Growth Methods**

Liliental-Weber, Z.; Jasinski, J.; Washburn, J.; 2002; 10p; In English

Report No.(s): DE2002-802040; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

In this paper defects formed in GaN grown by different methods are reviewed. The crystal growth direction and growth rate play important roles. For bulk crystals grown under high pressure the highest growth rates are for planes perpendicular to the c-axis. Only planar defects formed on c-planes are observed in these crystals. There are no threading dislocations or nanotubes in the c-direction. However, polarity of the growth direction plays a role in the surface roughness and the distribution of planar defects. For growth of homo-epitaxial and hetero-epitaxial layers the growth is forced to take place in the much slower c-direction. As a result defects related to the purity of constituents used for growth are formed such as nanotubes and pinholes. In addition threading dislocations and dislocations that accommodate lattice and thermal expansion mismatch are formed.

NTIS

*Gallium Nitrides; Crystal Growth; Defects; Epitaxy; Surface Roughness*

**20030017838** NASA Ames Research Center, Moffett Field, CA USA

**Simulation of the dc Plasma in Carbon Nanotube Growth**

Hash, David, NASA Ames Research Center, USA; Bose, Deepak, NASA Ames Research Center, USA; Govindan, T. R., NASA Ames Research Center, USA; Meyyappan, M., NASA Ames Research Center, USA; [2003]; 34p; In English  
Contract(s)/Grant(s): NAS2-99092; RTOP 704-05-04; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A model for the dc plasma used in carbon nanotube growth is presented, and one-dimensional simulations of an acetylene/ammonia/argon system are performed. The effect of dc bias is illustrated by examining electron temperature, electron and ion densities, and neutral densities. Introducing a tungsten filament in the dc plasma, as in hot filament chemical vapor deposition with plasma assistance, shows negligible influence on the system characteristics.

Author

*Carbon Nanotubes; Plasmas (Physics); Nanostructure Growth; Electron Energy; Acetylene; Ammonia; Argon*

**20030018451** Computer Sciences Corp., Moffett Field, CA USA

**Modeling of Schottky Barrier Modulation due to Oxidation at Metallic Electrode and Semiconducting Carbon Nanotube Junction**

Yamada, Toshishige, Computer Sciences Corp., USA; [2003]; 12p; In English  
Contract(s)/Grant(s): DTTS59-99-D-00437; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A model is proposed for the previously reported lower Schottky barrier for holes PHI (sub bH) in air than in vacuum at a metallic electrode - semiconducting carbon nanotube (CNT) junction. We assume that there is a transition region between the electrode and the CNT, and an appreciable potential can drop there. The role of the oxidation is to increase this potential drop with negatively charged oxygen molecules on the CNT, leading to lower PHI(sub Bh) after oxidation. The mechanism prevails in both p- and n-CNTs, and the model consistently explains the key experimental findings.

Author

*Carbon Nanotubes; Oxidation; Modulation; Mathematical Models; Semiconductor Junctions; Electrodes; Schottky Diodes; Metal Surfaces*

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PHYSICS OF ELEMENTARY PARTICLES AND FIELDS

*Includes quantum mechanics; theoretical physics; and statistical mechanics. For related information see also 72 Atomic and Molecular Physics, 73 Nuclear Physics, and 25 Inorganic, Organic and Physical Chemistry.*

**20030017760** California State Coll., Los Angeles, CA USA

**Perturbative Relations between Gravity and Gauge Theory**

Bern, Z.; Dixon, L.; Perelstein, M.; Dunbar, D. C.; Rozowsky, J. S.; Nov. 1999; 16p; In English  
Report No.(s): DE2002-802048; SLAC/PUB-8303; UCLA/99/TEP/36; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

We review the relations that have been found between multi-loop scattering amplitudes in gauge theory and gravity, and their implications for ultraviolet divergences in supergravity.

NTIS

*Gauge Theory; Gravitation Theory; Scattering Amplitude*

## ADMINISTRATION AND MANAGEMENT

*Includes management planning and research.*

**20030014754** National Center for Injury Prevention and Control, Atlanta, GA USA

**Demonstrating Your Program's Worth: A Primer on Evaluation for Programs to Prevent Unintentional Injury (Revised)**

Thompson, N. J.; McClintock, H. O.; Mar. 2000; 136p

Report No.(s): PB2003-102505; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

We wrote this book to show program managers how to demonstrate the value of their work to the public, to their peers, to funding agencies, and to the people they serve. In other words, we're talking about how to evaluate programs—a scary proposition for some managers. Our purpose is to reduce the scare factor and to show that managers and staff need not be apprehensive about what evaluation will cost or what it will show. In this book, we show why evaluation is worth the resources and effort involved. We also show how to conduct simple evaluation, how to hire and supervise consultants for complex evaluation, and how to incorporate evaluation activities into the activities of the injury prevention program itself. By learning to merge evaluation and program activities, managers will find that evaluation does not take as much time, effort, or money as they expected.

NTIS

*Injuries; Accident Prevention; Evaluation; Procedures*

**20030014755** General Accounting Office, Washington, DC USA

**Architect of the Capitol: Management and Accountability Framework Needed for Organizational Transformation**

Jan. 2003; 134p

Report No.(s): PB2003-102501; GAO-03-231; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

The Office of the Architect of the Capitol (AOC) plays an important role in supporting the effective functioning of the Congress and its neighboring institutions. With a budget of \$426 million, AOC is responsible for the maintenance, renovation, and new construction of all buildings and grounds within the Capitol Hill complex. GAO was mandated by the Legislative Branch Appropriations Act, 2002, to conduct a comprehensive management review of AOC's operations to help identify improvements in strategic planning, organizational alignment, and strategic human capital management to help AOC better achieve its mission and to address long-standing program issues. To address these objectives, GAO reviewed AOC's legislative authority and internal documents, interviewed key AOC officials and senior managers, and conducted employee focus groups.

NTIS

*Management Planning; Congressional Reports; Maintenance; Buildings; Architecture*

**20030014756** General Accounting Office, Washington, DC USA

**Contract Management: Postal Service's National Office Supply Contract Has Not Been Effectively Implemented**

Jan. 2003; 38p

Report No.(s): PB2003-102500; GAO-03-230; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Over the past 2 years, the Postal Service has experienced growing financial difficulties. In an effort to transform the organization to reduce costs and increase productivity, the Postal Service awarded a national-level office supply contract to Boise Corporation. In addition, the Postal Service required Boise to submit a subcontracting plan, which outlines how small, minority-, and woman-owned businesses will be reached through the contract. GAO was asked to assess the status of the Postal Service's implementation of the Boise contract and Boise's achievement of its subcontracting plan. GAO also reviewed the extent to which the Postal Service is buying office supplies directly from small, minority-, and woman-owned businesses.

NTIS

*Contract Management; Supplying; Congressional Reports*

**20030014797** Pennsylvania Transportation Inst., University Park, PA USA

**RAC Mentoring and Training Framework Educational Guidelines Final Report**

Anderson, J. A.; Davenport, A. F.; Horton, M. A.; Sep. 2002; 58p; In English

Report No.(s): PB2003-101945; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The American Association of State Highway and Transportation Officials (AASHTO) Research Advisory Board (RAC) advises the AASHTO Standing Committee on Research (SCOR), works with the National Cooperative Highway Research Program (NCHRP), performs high-value research, and works with the Transportation Research Information System (TRIS) and Research in Progress (RIP) systems. As such, RAC members perform many important functions. When they are promoted to their positions, many new RAC members lack a working knowledge of RAC's background, function and resources. This knowledge

is necessary to operate their state department of transportation (DOT) research program successfully, and maximize their function within the committee. New RAC members run the risk of being generally unaware and uninformed of the full scope of their duties, responsibilities, capabilities, contacts, and resources as RAC members. New RAC members need proper orientation instruction. As part of a program to inform, instruct, and provide assistance to new RAC members, RAC has developed an orientation program called RAC 101, and designed a Mentor-Protege Program. The objective of both RAC 101 and the Mentor-Protege Program is that new RAC members quickly and easily assimilate into the RAC community to maximize their effectiveness in their new roles and for their state DOT. RAC has long needed vehicles to build organizational identify and develop knowledge among its members. These two initiatives can help the organization move toward those goals. The pilot RAC 101 session was well received and is already being modified for future use. The mentoring program has been fleshed out and awaits implementation. Both programs have a good change of success, but their ultimate fate depends on senior RAC member support.

NTIS

*Transportation; Research Management; Highways*

**20030014830** NASA Ames Research Center, Moffett Field, CA USA

**A Constraint-based Attribute and Interval Planning**

Frank, Jeremy, NASA Ames Research Center, USA; Jonsson, Ari, Research Inst. for Advanced Computer Science, USA; 2001; 20p; In English; Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche; Distribution as joint owner in the copyright; Distribution as joint owner in the copyright

In this paper we introduce Constraint-based Attribute and Interval Planning (CAIP), a new paradigm for representing and reasoning about plans. The paradigm enables the description of planning domains with time, resources, concurrent activities, mutual exclusions among sets of activities, disjunctive preconditions and conditional effects. We provide a theoretical foundation for the paradigm using a mapping to first order logic. We also show that CAIP plans are naturally expressed by networks of constraints, and that planning maps directly to dynamic constraint reasoning. In addition, we show how constraint templates are used to provide a compact mechanism for describing planning domains.

Author

*Constraints; Properties; Intervals; Planning*

**20030015774** Naval Postgraduate School, Monterey, CA USA

**Summary of Research 2000, Department of Systems Management**

Euske, Kenneth J.; Liao, Shu S.; Dec. 2001; 136p; In English

Report No.(s): AD-A409357; NPS-09-02-010; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

This report contains project summaries of the research projects in the Department of Systems Management. A list of recent publications is also included, which consists of conference presentations and publications, books, contributions to books, published journal papers, and technical reports. Thesis abstracts of students advised by faculty in the Department are also included.

DTIC

*Systems Management; Students*

**20030016713** Istituto Superiore di Sanita, Rome, Italy

**Report of the Istituto Superiore di Sanita on the Activities Carried Out in 2000 and Program for 2002 *Relazione dell'Istituto Superiore di Sanita sui risultati dell'attivita svolta nell'esercizio finanziario 2000 e programma per l'esercizio 2002***

2001; 336p; In Italian

Report No.(s): PB2003-102599; ISTISAN-01/36; Copyright; Avail: National Technical Information Service (NTIS), Microfiche

The results of the activities carried out by the Istituto Superiore di Sanita (Italian National Institute of Health) in 2000 and the program for 2002 are presented. The report is organized into five sections: (1) summary of the activities: general data, international relationships and activity supported by technical services; (2) research activities: research projects of the Institute, projects financed by the National Health Fund, national programs on AIDS, projects carried out within cooperation agreements and other research activities; (3) institutional activities such as prevention, control, surveillance and counseling in public health; (4) institutional plan for 2002; (5) publications produced in 2000.

NTIS

*Public Health; Prevention*

**20030017759** Coast Guard, Washington, DC USA

**Risk-Based Decision-Making (RBDM) Guidelines, Volume 4, Resources for Risk-Based Decision-Making**

2002; In English

Report No.(s): PB2002-500115; No Copyright; Avail: National Technical Information Service (NTIS)

This CD-ROM contains the RBDM Guidelines: the concepts, tools, and examples which provide proven methods for addressing real decision-making needs in the marine safety, security, and environmental protection arenas. Decision makers throughout the marine industry will find the insights, suggestions, and procedures in the Guidelines valuable in the conduct of their operations. There are 4 volumes. Volume 1 is a guide to finding specific advice, guidance, and examples in the remaining volumes. Volume 2 provides the basics of Risk-Based Decision-Making (RBDM) and explains key steps in the process. Chapters 1-4 offer the principles of RBDM and risk assessment, management, and communication, while chapters 5-7 presents an overview of assessments tools. Volume 3 provides guidance on getting started with risk assessment applications and specific steps for applying specific risk assessment tools. Volume 4 is an electronic library of resource materials on CD-ROM. In addition to electronic versions of material from Volume 1-3, Volume 4 provides information on other risk assessment methods and tools; example risk assessment from the field; a data source compendium for finding data on risk assessments; and job aids, such as checklists, for use in the field.

NTIS

*Armed Forces; Decision Making; Coasts; Risk; Guidance (Motion)*

**20030017765** General Accounting Office, Washington, DC USA

**High-Risk Series: Federal Real Property, January 2003**

Jan. 2003; 68p; In English

Report No.(s): PB2003-102589; GAO-03-122; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Over 30 agencies control hundreds of thousands of real property assets worldwide, including facilities and land, which are worth hundreds of billions of dollars. Unfortunately, much of this vast, valuable portfolio reflects an infrastructure based on the business model and technological environment of the 1950s. Many of the assets are no longer effectively aligned with, or responsive to, agencies' changing missions and are therefore no longer needed. Further, many assets are in an alarming state of deterioration; agencies have estimated restoration and repair needs to be in the tens of billions of dollars. Compounding these problems are the lack of reliable government-wide data for strategic asset management, a heavy reliance on costly leasing instead of ownership to meet new needs, and the cost and challenge of protecting these assets against potential terrorism. To address these challenges, Congress and the administration have undertaken several efforts. While some of these efforts and other work by individual real property-holding agencies have had some success, much remains to be done government-wide. Given the persistence of the problems and related obstacles, we have added federal real property as a new high-risk area.

NTIS

*Risk; Commerce; Maintenance; Data Management*

**20030017766** General Accounting Office, Washington, DC USA

**Major Management Challenges and Program Risks: National Aeronautics and Space Administration (January 2003)**

Jan. 2003; 40p; In English

Report No.(s): PB2003-102581; GAO-03-114; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report addresses the major management challenges and program risks facing the National Aeronautics and Space Administration (NASA) as it seeks to advance human exploration and development of space, advance and communicate scientific knowledge, and research and develop aeronautics and space technologies. The report discusses the actions that NASA has taken and that are under way to address the challenges GAO identified in its Performance and Accountability Series 2 years ago, and major events that have occurred that significantly influence the environment in which the agency carries out its mission. Also, GAO summarizes the challenges that remain, new ones that have emerged, and further actions that GAO believes are needed. This analysis should help the new Congress and the administration carry out their responsibilities and improve government for the benefit of the American people. In its 2001 performance and accountability report on NASA, GAO identified important management, oversight, and workforce issues facing the agency. The information GAO presents in this report is intended to help sustain congressional attention and an agency focus on continuing to make progress in addressing these challenges-and others that have arisen since 2001-and ultimately overcoming them. This report is part of a special series of reports on government wide and agency specific issues.

NTIS

*Accounting; Federal Budgets; Management Planning*

**20030017767** General Accounting Office, Washington, DC USA

**Major Management Challenges and Program Risks: A Governmentwide Perspective. Performance and Accountability Series (January 2003)**

Jan. 2003; 58p

Report No.(s): PB2003-102562; GAO-03-95; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This report addresses the challenges and opportunities the federal government faces to enhance its performance, ensure greater accountability, and better position the nation for the future. It describes the major trends, including demographic, health care, and other pressures that affect our nation's long-term fiscal outlook. These trends continue to drive the need for a major transformation in government, and some agencies have related efforts under way. This report also discusses the continuing need to build fundamental management capacity across government in order to resolve high-risk areas and effectively address major management challenges. This analysis should help the new Congress and the administration carry out their responsibilities and improve government for the benefit of the American people.

NTIS

*Accounting; Federal Budgets; Management Planning*

**20030018105** NASA Ames Research Center, Moffett Field, CA USA

**A Survey of Knowledge Management Research & Development at NASA Ames Research Center**

Keller, Richard M., NASA Ames Research Center, USA; Apr. 30, 2002; 14p; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This chapter catalogs knowledge management research and development activities at NASA Ames Research Center as of April 2002. A general categorization scheme for knowledge management systems is first introduced. This categorization scheme divides knowledge management capabilities into five broad categories: knowledge capture, knowledge preservation, knowledge augmentation, knowledge dissemination, and knowledge infrastructure. Each of nearly 30 knowledge management systems developed at Ames is then classified according to this system. Finally, a capsule description of each system is presented along with information on deployment status, funding sources, contact information, and both published and internet-based references.

Author

*Knowledge; Research and Development; Information Management; Management Systems*

**82**

**DOCUMENTATION AND INFORMATION SCIENCE**

*Includes information management; information storage and retrieval technology; technical writing; graphic arts; and micrography. For computer documentation see 61 Computer Programming and Software.*

**20030014804** NASA Ames Research Center, Moffett Field, CA USA

**The Social Life of a Data Base**

Linde, Charlotte, NASA Ames Research Center, USA; Wales, Roxana, Science Applications International Corp., USA; [2002]; 8p; In English; Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche; Distribution as joint owner in the copyright; Distribution as joint owner in the copyright

This paper presents the complex social life of a large data base. The topics include: 1) Social Construction of Mechanisms of Memory; 2) Data Bases: The Invisible Memory Mechanism; 3) The Human in the Machine; 4) Data of the Study: A Large-Scale Problem Reporting Data Base; 5) The PRACA Study; 6) Description of PRACA; 7) PRACA and Paper; 8) Multiple Uses of PRACA; 9) The Work of PRACA; 10) Multiple Forms of Invisibility; 11) Such Systems are Everywhere; and 12) Two Morals to the Story. This paper is in viewgraph form.

CASI

*Data Bases; Complex Systems; Systems Engineering; Artificial Intelligence*

**20030015392** Naval Postgraduate School, Monterey, CA USA

**Summary of Research 2000, Department of Electrical and Computer Engineering**

Knorr, Jeffrey B.; Tummala, Murali; Dec. 2001; 105p; In English

Report No.(s): AD-A409394; NPS-09-02-011; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

This report contains project summaries of the research projects in the Department of Electrical and Computer Engineering. A list of recent publications is also included, which consists of conference presentations and publications, books, contributions

to books, published journal papers, and technical reports. Thesis abstracts of students advised by faculty in the Department are also included.

DTIC

*Information Systems; Computers*

**20030015736** Commerce Dept., Technology Administration, Washington, DC USA

**Visions 2020: Transforming Education and Training Through Advanced Technologies**

2003; 90p; In English

Report No.(s): PB2003-102444; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

Contents include the following: Introduction; Overview; Learning 2020 - Innovative, Creative, Collaborative Workforce; It Begins at Birth - Intelligent Toys; Preschool - Game Based Learning; The Early Years - Social Collaboration and Filtering; Auto-Recommended Group Formation; Student Generated Interactive e-Books; Virtual Mentors; Kindergarten 2020 Scenario; High School - Increased Community Communication; Personalized Digital Libraries in Project Based Learning; Internet in Your Ear; Ubiquitous Student Controlled Interfaces; Learning Style Adaptation; High School 2020 Scenario; College and Lifelong Learning; Super Simulations and Sensors; Intelligent Laboratory Objects; Project Management; Higher Education 2020 Scenario; Lifelong Learner 2020 Scenario; Acknowledgements; Author's Background.

NTIS

*Education; Schools*

**20030015752** NASA Langley Research Center, Hampton, VA USA

**The NASA Scientific and Technical Information (STI) Program's Implementation of Open Archives Initiation (OAI) for Data Interoperability and Data Exchange**

Rocker, JoAnne, NASA Langley Research Center, USA; Roncaglia, George J., NASA Langley Research Center, USA; Heimerl, Lynn N., NASA Langley Research Center, USA; Nelson, Michael L., NASA Langley Research Center, USA; [2002]; 10p; In English; SLA 2002 Annual Special Libraries Association Conference, 8-13 Jun. 2002, Los Angeles, CA, USA; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Interoperability and data-exchange are critical for the survival of government information management programs. E-government initiatives are transforming the way the government interacts with the public. More information is to be made available through web-enabled technologies. Programs such as the NASA's Scientific and Technical Information (STI) Program Office are tasked to find more effective ways to disseminate information to the public. The NASA STI Program is an agency-wide program charged with gathering, organizing, storing, and disseminating NASA-produced information for research and public use. The program is investigating the use of a new protocol called the Open Archives Initiative (OAI) as a means to improve data interoperability and data collection. OAI promotes the use of the OAI harvesting protocol as a simple way for data sharing among repositories. In two separate initiatives, the STI Program is implementing OAI in collaboration with the Air Force, Department of Energy, and Old Dominion University, the NASA STI Program has funded research on implementing the OAI to exchange data between the three organizations. The second initiative is the deployment of OAI for the NASA technical report server (TRS) environment. The NASA TRS environment is comprised of distributed technical report servers with a centralized search interface. This paper focuses on the implementation of OAI to promote interoperability among diverse data repositories.

Author

*Data Acquisition; Information Dissemination; Interoperability; Protocol (Computers)*

**20030015764** Air Force Academy, Library, CO USA

**America's Challenges in an Unstable World: Balancing Security with Liberty**

Scott, Frances K.; Oct. 2002; 37p; In English

Report No.(s): AD-A409342; SPECIAL BIB SER-100; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

In support of the Academy Assembly, the Directorate of Libraries produces a special bibliography of Air Force Academy library materials relevant to the current year's theme. The theme for the 2002/2003 academic year is: America's Challenges in an Unstable World: Balancing Security with Liberty. This year's bibliography, number 100 in the library's Special bibliography Series, was prepared by Frances K. Scott Social Sciences Bibliographer and Reference Librarian.

DTIC

*Security; Bibliographies*

**20030015773** Naval Postgraduate School, Monterey, CA USA

**Summary of Research 2000, Interdisciplinary Academic Groups**

Boger, Dan; Powell, James; Zyda, Michael J.; Panholzer, Rudolf; McCormick, Gordon; Dec. 2001; 152p; In English  
Report No.(s): AD-A409353; NPS-09-02-013; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

This report contains project summaries of the research projects in the Interdisciplinary Academic Groups: Command, Control, Communications, Computers and Intelligence; Information Systems; Information Warfare; Modeling, Virtual Environments and Simulation; Space Systems; Special Operations; and Undersea Warfare. A list of recent publications is also included, which consists of conference presentations and publications, books, contributions to books, published journal papers, and technical reports. Thesis abstracts of students advised of an interdisciplinary nature are also included.

DTIC

*Information Systems; Intelligence; Warfare; Command and Control*

**20030016562** Loughborough Univ. of Technology, Dept. of Information Sciences, UK

**To Determine the Efficacy of Headings in the Representation of Clinical Data**

Price, S.; Summers, R.; Oct. 25, 2001; 5p; In English; Papers from 23rd Annual International Conference of the IEEE Engineering in Medicine and Biology Society, Oct 25-28, 2001, held in Istanbul, Turkey. See also ADM001351 for entire conference on CD-ROM

Report No.(s): AD-A409554; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

During the autumn of 2000, 80 clinicians took part in a study to test a set of Clinical Headings developed to facilitate clinical communication. Real- world patient scenarios were used to develop a simulator to test current and re-structured clinical documentation. The relationship between perceived use and actual results was explored The project raised awareness of the important issues from the clinical perspective on the introduction of Headings in electronic clinical note-keeping.

DTIC

*Management Information Systems; Clinical Medicine; Effectiveness; Data Bases*

**89**

**ASTRONOMY**

*Includes observations of celestial bodies, astronomical instruments and techniques; radio, gamma-ray, x-ray, ultraviolet, and infrared astronomy; and astrometry.*

**20030015406** Smithsonian Astrophysical Observatory, Cambridge, MA USA

**High Resolution Imaging of Circumstellar Disks at Millimeter Wavelengths Annual Report, 1 Mar. 2002 - 28 Feb. 2003**

Wilner, David J., Smithsonian Astrophysical Observatory, USA; January 2003; 6p; In English

Contract(s)/Grant(s): NAG5-11777; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Our program uses the techniques of millimeter interferometry to make high resolution observations of dust continuum emission to study the structure of protoplanetary disks and debris disks around nearby stars. Observations of dust emission at these wavelengths are advantageous because the dust emission is generally optically thin and directly proportional to mass, and contrast with stellar photospheres is not a problem. We are using of several observational facilities, including (1) the Very Large Array (VLA) of the National Radio Astronomy Observatories, (2) the Plateau de Bure Interferometer (PdBI) of the Institut de RadioAstronomie Millimetrique, and (3) the Submillimeter Array (SMA), now under construction by the Smithsonian Astrophysical Observatory and Academia Sinica (Taiwan). In the past year, we have accomplished the following (more details below): (1) We continued work on our 'low resolution' VLA survey of disks in Herbig Ae star and binary systems, primarily to identify candidates for higher resolution follow-up. We have submitted a paper for publication on the detailed analysis of the structure of the disk around CQ Tauri; (2) We completed analysis of our PdBI observations of the debris disk around Vega, and we presented these results at (1) the 199th AAS meeting in Washington, DC, and (2) a symposium in memory of Fred Gillett on Debris Disks and the Formation of Planets, in Tucson, AZ; (3) We continue commissioning observations with the SMA, which include the first ever interferometric images in the 850 micron wavelength band, in preparation for eventually imaging debris disks.

Author

*Protoplanetary Disks; High Resolution; Interstellar Matter; Stellar Evolution; Astronomical Interferometry*

**20030015410** Smithsonian Astrophysical Observatory, Cambridge, MA USA

**Liners and Low Luminosity AGN in the ROSAT Database Final Report, 1 Aug. 1997 - 31 Jul. 2002**

Elvis, Martin, Smithsonian Astrophysical Observatory, USA; January 2003; 4p; In English

Contract(s)/Grant(s): NAG5-4808; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

This program has led to a series of papers being written and published in the Astrophysical Journal. Together these papers try to explain major parts of the LINER and low luminosity AGN puzzle. One paper ('Accretion Disk Instabilities, Cold Dark Matter Models, and Their Role in Quasar Evolution', Hatziminaoglou E., Siemiginowska A., & Elvis M., 2001, ApJ, 547, 90) describes an analytical model for the evolution of the quasar luminosity function. By combining the Press-Schechter formalism for the masses of initial structures with the luminosity distribution for a population of single mass black holes given by an unstable accretion disk an almost complete end-to-end physics-based model of quasar evolution is produced. In this model black holes spend 75% of their time in a low accretion state (at  $L(\text{Edd})$ ). This low state population of black holes is likely to be observed as the LINER and low luminosity AGNs in the local universe. Another paper ('Broad Emission Line Regions in AGN: the Link with the Accretion Power', Nicastro F., 2000, ApJ Letters, 530, L65) gives a physical basis for why low state black holes appear as LINERS. by linking the Lightman-Eardley instability in an accretion disk to the origin of a wind that contains the broad emission line cloud material this model explains the large widths seen in these lines as being the Keplerian velocity of the disk at the instability radius. For LINERS the key is that below an accretion rate of  $10(\text{exp } -3)M(\text{sub Edd})$  the Lightman-Eardley instability falls within the innermost stable orbit of the disk, and so leaves the entire disk stable. No wind occurs, and so no broad emission lines are seen. Most LINERS are likely to be black holes in this low state. Tests of this model are being considered.

Author

*Stellar Luminosity; ROSAT Mission; Active Galactic Nuclei; Quasars; Stellar Evolution; Black Holes (Astronomy); Stellar Models*

**20030015841** Duke Univ., Trinity Coll., Durham, NC USA

**Rotational Shear Interferometry for Astronomical Imaging**

Crawford, Bristol J.; Jan. 2002; 90p; In English

Report No.(s): AD-A409524; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

An astronomical imaging instrument was developed which coupled a rotational shear interferometer (RSI) to a telescope with numerical aperture (NA) matching optics. The instrument was designed and constructed. Computer software was written to assist in the NA matching and perform rudimentary wavelength filtering. The completed astronomical imaging instrument was used to image a synthetic binary star created out of light emitting diodes (LEDs) with varying separation and spectrum. Results show that the RSI/telescope combination can image sparse arrays of point sources with small angular separation. Atmospheric turbulence was introduced, and the RSI/telescope instrument was tested for sensitivity to phase distortions.

DTIC

*Imaging Techniques; Optical Measuring Instruments; Astronomical Interferometry; Apertures; Atmospheric Turbulence; Shear Properties*

**20030016189** Extrasolar Research Corp., Pasadena, CA USA

**The Anatomy of the Perseus Spiral ARM: (sup 12)CO and IRAS Imaging Observations of the W3-W4-W5 Cloud Complex**

Heyer, Mark H., Massachusetts Univ., USA; Terebey, S., Extrasolar Research Corp., USA; The Astrophysical Journal; Jul. 20, 1998; Volume 502, pp. 265-277; In English

Contract(s)/Grant(s): NAS5-97066; NAG5-28916; NSF AST-94-20159; Copyright; Avail: Issuing Activity

Panoramic images of (sup 12)CO J = 1-0 and thermal dust emissions from the W3-W4-W5 region of the outer Galaxy are presented. These data and recently published H (sub I) 21 cm line emission images provide an approx. 1 min resolution perspective to the dynamics and thermal energy content of the interstellar gas and dust components contained within a 9 deg arc of the Perseus spiral arm. We tabulate the molecular properties of 1560 clouds identified as closed surfaces within the 1-b-v CO data cube at a threshold of  $0.9 \text{ K T}(\text{sup } *) (\text{sub } R)$ . Relative surface densities of the molecular (28:1) and atomic (2.5: 1) gas components determined within the arm and interarm velocity intervals demonstrate that the gas component that enters the spiral arm is predominantly atomic. Molecular clouds must necessarily condense from the compressed atomic material that enters the spiral arm and are likely short lived within the interarm regions. From the distribution of centroid velocities of clouds, we determine a random cloud-to-cloud velocity dispersion of 4 km/s over the width of the spiral arm but find no clear evidence within the molecular gas for streaming motions induced by the spiral potential. The far-infrared images are analyzed with the CO J = 1-0 and H (sub I) 21 cm line emission. The enhanced UV radiation field from members of the Cas OB6 association and embedded newborn stars provide a significant source of heating to the extended dust component within the Perseus arm relative to the

quiescent cirrus regions. Much of the measured far-infrared flux (69% at 60 microns and 47% at 100 microns) originates from regions associated with star formation rather than the extended, infrared cirrus component.

Author

*Galactic Structure; Milky Way Galaxy; Infrared Astronomy; Molecular Clouds; Interstellar Matter; Ultraviolet Astronomy; Thermal Emission; Microwave Spectra*

**20030016517** Space Telescope Science Inst., Baltimore, MD USA

**A Study of Imaging Interferometer Simulators *Final Report, 1 Oct. 2001 - 30 Sep. 2002***

Allen, Ronald J., Space Telescope Science Inst., USA; Dec. 23, 2002; 7p; In English

Contract(s)/Grant(s): NAG5-11360; STScI Proj. J0352; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Several new space science mission concepts under development at NASA-GSFC for astronomy are intended to carry out synthetic imaging using Michelson interferometers or direct (Fizeau) imaging with sparse apertures. Examples of these mission concepts include the Stellar Imager (SI), the Space Infrared Interferometric Telescope (SPIRIT), the Submillimeter Probe of the Evolution of Cosmic Structure (SPECS), and the Fourier-Kelvin Stellar Interferometer (FKSI). We have been developing computer-based simulators for these missions. These simulators are aimed at providing a quantitative evaluation of the imaging capabilities of the mission by modelling the performance on different realistic targets in terms of sensitivity, angular resolution, and dynamic range. Both Fizeau and Michelson modes of operation can be considered. Our work is based on adapting a computer simulator called imSIM, which was initially written for the Space Interferometer Mission in order to simulate the imaging mode of new missions such as those listed. In a recent GSFC-funded study we have successfully written a preliminary version of a simulator SISIM for the Stellar Imager and carried out some preliminary studies with it. In a separately funded study we have also been applying these methods to SPECS/SPIRIT.

Derived from text

*Computerized Simulation; Submillimeter Waves; Imaging Techniques; Michelson Interferometers*

**20030016528** Instituto Nacional de Pesquisas Espaciais, Sao Jose dos Campos, Brazil

**High Energy-Astrophysics: Development of the MASCO Telescope and GRO J1744-28 Observations with the SIGMA Telescope *Astrofisica de Altas Energias: Desenvolvimento do Telescopio MASCO e Observacoes de GRO J1744-28 Com o Telescopio SIGMA***

Cabeza, Jorge Mejia, Instituto Nacional de Pesquisas Espaciais, Brazil; 2002; 180p; In Portuguese

Report No.(s): INPE-9283-TDI/818; No Copyright; Avail: CASI; A09, Hardcopy; A02, Microfiche

In this work, the results corresponding to the development of the MASCO telescope and to the analysis of high-energy images of the Galactic Center region obtained with the SIGMA telescope are presented. The MASCO telescope employs a rotating MURA-based coded mask and it was designed to obtain high-resolution images of cosmic sources in the 50 keV to 1.3 MeV energy band on board stratospheric balloons. The assembling process of the gondola and of the attitude control systems is described. These systems were designed to ensure the determination of the telescope's pointing coordinates with a precision better than 15 min during the flights. The main characteristics of the imaging system are presented: spatial resolution of 1.8 cm at 60 keV and 1.95 cm at 511 keV; spectral resolution of 25.8% at 60 keV and 9.8% at 511 keV; temporal resolution of 25 microseconds; effective area of 154.4 sq cm at 75 keV and 170.2 sq cm at 500 keV; sensitivity (3sigma; 6h of observation time) of  $1.3 \times 10^{sup -5}$  photons/sq cm/s/keV at 75 keV. The MASCO image reconstruction software was developed, which takes into account the effects of the telescope's drift during the flights and of the apparent sky movement caused by the use of an alt-azimuthal mounting. Laboratory images of a radioactive source obtained with mask, mask-antimask and rotating mask techniques are presented, as well as simulations of the effects of the telescope's drift and apparent sky movement, with the corresponding applied corrections. It is shown that the apparent sky movement can be used as an alternative to determine the real cosmic source image out of the spurious images present in the reconstruction process inherent to telescopes that employ non-rotating extended URA masks. Galactic Center data from the SIGMA telescope were analyzed in order to compare the reduction and data analysis processes of both instruments. The behaviour of the source GRO J1744-28 was studied during part of its 1996 and 1997 outbursts. In 1996, the source's flux in the 35 to 75 keV energy band was  $85 \pm 6.4$  mcrab. In 1997, the source's flux in the same energy band was  $52 \pm 7.4$  mcrab. In both cases, the source's spectra were well fitted by a optically-thin thermal Bremsstrahlung with temperatures  $kT(sub\ Brems)$  of  $28 \pm 7$  keV and  $18(sub +12)(sub -7)$  keV, and fluxes of  $(3.6 \pm 0.6) \times 10^{(exp -4)}$  and  $(2.3 \pm 0.7) \times 10^{(sup -4)}$  photons/ sq cm/s/keV at 50 keV, respectively. The source was not detected at energies above 75 keV. Combining the SIGMA and BATSE data for the 1997 outbursts, it was found evidence showing that the bursts in this period were produced by instability in the accretion process. For the remaining sessions, upper limits for the source flux intensities were determined. With the coded mask technique, it was possible to identify, in an unambiguous way, GRO J1744-28 in the very crowded region of the Galactic Center, avoiding the contamination by other sources in the determination of its characteristics. Specifically, during the second

outburst it was possible to isolate the signal from the sources GRO J1744-28, 1E1740.7-2942 and GRS 1737-31, obtaining evidence that this last source could have contaminated the BATSE measurements in the same period, leading to erroneous results previously reported in the literature.

Author

*Telescopes; Gamma Ray Astronomy; X Ray Astronomy; Attitude Control; Image Reconstruction; Milky Way Galaxy; Galactic Nuclei*

**20030016707** Lawrence Livermore National Lab., Livermore, CA USA

**Neptune and Titan Observed with Keck Telescope Adaptive Optics**

Max, C. E.; Macintosh, B. A.; Gibbard, S.; Gavel, D. T.; Roe, H.; May 05, 2000; 14p; In English

Report No.(s): DE2002-792749; UCRL-JC-136493; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

We report on observations taken during engineering science validation time using the new adaptive optics system at the 10-m Keck II Telescope. We observed Neptune and Titan at near-infrared wavelengths. These objects are ideal for adaptive optics imaging because they are bright and small, yet have many diffraction-limited resolution elements across their disks. In addition Neptune and Titan have prominent physical features, some of which change markedly with time. We have observed infrared-bright storms on Neptune, and very low-albedo surface regions on Titan, Saturn's largest moon. Spatial resolution on Neptune and Titan was 0.05-0.06 and 0.04-0.05 arc sec, respectively.

NTIS

*Neptune (Planet); Titan; Adaptive Optics; Telescopes*

**20030016758** Space Telescope Science Inst., Baltimore, MD USA

**Study of the Imaging Capabilities of SPIRIT/SPECS Concept Interferometers Final Report, 15 Jun. 2001 - 23 Dec. 2003**

Allen, Ronald J., Space Telescope Science Inst., USA; Dec. 23, 2002; 6p; In English

Contract(s)/Grant(s): NAG5-11024; STScI Proj. J0332; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Several new space science mission concepts under development at NASA-GSFC for astronomy are intended to carry out synthetic imaging using Michelson interferometers or direct (Fizeau) imaging with sparse apertures. Examples of these mission concepts include the Stellar Imager (SI), the Space Infrared Interferometric Telescope (SPIRIT), the Submillimeter Probe of the Evolution of Cosmic Structure (SPECS), and the Fourier-Kelvin Stellar Interferometer (FKSI). We have been developing computer-based simulators for these missions. These simulators are aimed at providing a quantitative evaluation of the imaging capabilities of the mission by modeling the performance on different realistic targets in terms of sensitivity, angular resolution, and dynamic range. Both Fizeau and Michelson modes of operation can be considered. Our work is based on adapting a computer simulator called imSIM which was initially written for the Space Interferometer Mission in order to simulate the imaging mode of new missions such as those listed. This report covers the activities we have undertaken to provide a preliminary version of a simulator for the SPIRIT mission concept.

Derived from text

*Space Missions; Computerized Simulation; Michelson Interferometers; Imaging Techniques; Computer Techniques*

**20030018254** Smithsonian Astrophysical Observatory, Cambridge, MA USA

**Simultaneous X-Ray and Optical Timing Observations of GX 339-4 Annual Report, 1 Apr. 2002 - 31 Mar. 2003**

Kaaret, Philip, Smithsonian Astrophysical Observatory, USA; February 2003; 1p; In English

Contract(s)/Grant(s): NAG5-10627; No Copyright; Avail: Issuing Activity; Abstract Only

The goal of this proposal is to perform the first comprehensive study of the correlated x-ray and optical variability of the Galactic accreting black hole candidate GX 339-4 using the x-ray and optical instruments on XMM-Newton. With these observations, we hope to make significant progress in understanding the coupled inflow - outflow system around a persistently accreting stellar mass black hole. We are currently analyzing the data. The data analysis is rather complex as it involves all of the instruments on XMM-Newton, the EPIC-PN, the EPIC-MOS, the RGS, and the OM, and our analysis requires study of correlated fast variability in the EPIC-PN and OM. We expect to have results ready to submit for publication within 3 to 4 months.

Author

*X Ray Optics; Black Holes (Astronomy); Optical Measuring Instruments; Optical Equipment*

**20030018454** Smithsonian Astrophysical Observatory, Cambridge, MA USA

**The Ultra-Soft X-ray Background: A Probe of the Hot Interstellar Medium and the Local Bubble - ADP-99 Final Report, 1 Mar. 2000 - 31 Aug. 2003**

Smith, Randall, Smithsonian Astrophysical Observatory, USA; February 2003; 2p; In English

Contract(s)/Grant(s): NAG5-9132; No Copyright; Avail: Issuing Activity; Abstract Only

The Ultra-Soft X-ray Telescope (UXT) was a sounding rocket mission flown three times in 1984 - 1986. At the beginning of the project, the data existed solely in form of raw telemetry data stored on 9 track tapes. The primary goal of this proposal has been to extract event files from the raw telemetry stream and to create instrument response models and calibrated spectra from it. We have completed this project, and the data will soon be available to all via the HEASARC archive of high-energy data at Goddard Space Flight Center. We are in the process of combining the results with the ALEXIS and DXS observations of the Local Bubble in modelling the 72 eV iron line (recently observed by the X-ray Quantum Calorimeter) and the carbon emission lines that are uniquely visible in this dataset. Our results agree with the XQC observation which predicts a maximum emission in the 72 eV iron lines that is below the limit observable with UXT. However, this leaves an open question as to what lines were responsible for the observed Be-band emission. The answer to this question will likely require more observations of soft X-rays with the Chandra LETGS and new atomic data models of potentially emitting ions.

Author

*Interstellar Matter; X Ray Telescopes; Sounding Rockets; Emission Spectra; Calorimeters; Telemetry*

## 90

### ASTROPHYSICS

*Includes cosmology; celestial mechanics; space plasmas; and interstellar and interplanetary gases and dust.*

**20030014814** NASA Ames Research Center, Moffett Field, CA USA

**Polycyclic Aromatic Hydrocarbons and the Diffuse Interstellar Bands: A Survey**

Salama, F., NASA Ames Research Center, USA; Galazutdinov, G. A., Special Astrophysical Observatory, USSR; Krelowski, J., Nicolaus Copernicus Univ., Poland; Allamandola, L. J., NASA Ames Research Center, USA; Musaev, F. A., Special Astrophysical Observatory, USSR; Feb. 04, 1999; 34p; In English

Contract(s)/Grant(s): NCC2-850; MEN/NSF-94-196; RFBR-98-02-16544; Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche; Distribution as joint owner in the copyright; Distribution as joint owner in the copyright

We discuss the proposal relating the origin of some of the diffuse interstellar bands (DIBs) to neutral and ionized polycyclic aromatic hydrocarbons (PAHs) present in interstellar clouds. Laboratory spectra of several PAHs, isolated at low temperature in inert gas matrices, are compared with an extensive set of astronomical spectra of reddened, early type stars. From this comparison, it is concluded that PAN ions are good candidates to explain some of the DIBs. Unambiguous assignments are difficult, however, due to the shift in wavelengths and the band broadening induced in the laboratory spectra by the solid matrix. Definitive band assignments and, ultimately, the test of the of the proposal that PAH ions carry some of the DIB must await the availability of gas-phase measurements in the laboratory. The present assessment offers a guideline for future laboratory experiments by allowing the preselection of promising PAH molecules to be studied in jet expansions.

Author

*Polycyclic Aromatic Hydrocarbons; Diffuse Interstellar Bands; Interstellar Matter; Molecular Clouds; Astronomical Spectroscopy*

**20030014815** California Univ., Inst. of Geophysics and Planetary Physics, Los Angeles, CA USA

**Interplanetary Magnetic Field Control of the Entry of Solar Energetic Particles into the Magnetosphere**

Richard, R. L., California Univ., USA; El-Alaoui, M., California Univ., USA; Ashour-Abdalla, M., California Univ., USA; Walker, R. J., California Univ., USA; Journal of Geophysical Research; 2002; ISSN 0148-0227; Volume 107, No. A8, pp. 7-1 - 7-18; In English

Contract(s)/Grant(s): NAG5-6689; Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche; Distribution as joint owner in the copyright; Distribution as joint owner in the copyright

We have investigated the entry of energetic ions of solar origin into the magnetosphere as a function of the interplanetary magnetic field orientation. We have modeled this entry by following high energy particles (protons and 3 He ions) ranging from 0.1 to 50 MeV in electric and magnetic fields from a global magnetohydrodynamic (MHD) model of the magnetosphere and its interaction with the solar wind. For the most part these particles entered the magnetosphere on or near open field lines except for some above 10 MeV that could enter directly by crossing field lines due to their large gyroradii. The MHD simulation was driven

by a series of idealized solar wind and interplanetary magnetic field (IMF) conditions. It was found that the flux of particles in the magnetosphere and transport into the inner magnetosphere varied widely according to the IMF orientation for a constant upstream particle source, with the most efficient entry occurring under southward IMF conditions. The flux inside the magnetosphere could approach that in the solar wind implying that SEPs can contribute significantly to the magnetospheric energetic particle population during typical SEP events depending on the state of the magnetosphere.

Author

*Interplanetary Magnetic Fields; Magnetohydrodynamics; Energetic Particles; Solar Wind; Earth Magnetosphere*

**20030014851** Academy of Sciences (USSR), Space Research Inst., Moscow, USSR

**Experimental Modeling of Impact-Induced High-Temperature Processing of Silicates**

Gerasimov, M. V., Academy of Sciences (USSR), USSR; Dikov, Y. P., Academy of Sciences (USSR), USSR; Yakovlev, O. I., Academy of Sciences (USSR), USSR; Impact Cratering: Bridging the Gap Between Modeling and Observations; 2003, pp. 21; In English; Also announced as 20030014839

Contract(s)/Grant(s): RFBR-01-05-64564; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Large scale impacts of asteroids and meteorites play an important role in the evolution of planets and their satellites. Pulse input of huge energy during an impact results in noticeable changes in both mechanical and geochemical state of colliding material. The complexity of geochemical processes during an impact suggests experimental modeling as the main tool of its investigation rather than computing approach. On the other side, the modeling of mechanical issues of large scale impacts is mainly a success of computations. We need to have a good cooperation between both computer modeling of mechanical issues of an impact and experimental investigations of geochemical processes to build up a more or less realistic picture of a large-scale impact.

Author

*Experimentation; Models; Impact Strength; High Temperature; Silicates*

**20030014852** Witwatersrand Univ., Impact Cratering Research Group, Johannesburg, South Africa

**Thermal and Dynamic Consequences of Impact: Lessons from Large Impact Structures**

Gibson, Roger L., Witwatersrand Univ., South Africa; Reimold, W. Uwe, Witwatersrand Univ., South Africa; Impact Cratering: Bridging the Gap Between Modeling and Observations; 2003, pp. 22-23; In English; Also announced as 20030014839; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

In the early years following the recognition of meteorite impact cratering as an important geological process within the Solar System, impact researchers were largely confined to inferring cratering mechanics from studies of surface crater morphologies and small-scale experiments. With the advent of sophisticated computer-based numerical simulations and high-resolution geophysics, however, researchers have begun to explore more fully the detailed 3-D structure of craters and the processes that give rise to them. This paper examines some of the issues raised by the model simulations from the perspective of the field evidence presented in impact structures, with particular reference to the Vredefort structure in South Africa.

Author

*Craters; Geology; Geophysics; Hypervelocity; Meteorite Collisions; Solar System*

**20030014853** Los Alamos National Lab., NM USA

**Two- and Three-Dimensional Simulations of Asteroid Ocean Impacts**

Gisler, G., Los Alamos National Lab., USA; Weaver, R. P., Los Alamos National Lab., USA; Mader, C. L., Los Alamos National Lab., USA; Gittings, M. L., Science Applications International Corp., USA; Impact Cratering: Bridging the Gap Between Modeling and Observations; 2003, pp. 24; In English; Also announced as 20030014839; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

We have performed a series of two-dimensional and three-dimensional simulations of asteroid impacts into an ocean using the SAGE code from Los Alamos National Laboratory and Science Applications International Corporation. The SAGE code is a compressible Eulerian hydrodynamics code using continuous adaptive mesh refinement for following discontinuities with a fine grid while treating the bulk of the simulation more coarsely. We have used tabular equations of state for the atmosphere, water, the oceanic crust, and the mantle. In two dimensions, we simulated asteroid impactors moving at 20 km/s vertically through an exponential atmosphere into a 5 km deep ocean. The impactors were composed of mantle material (3.32 g/cc) or iron (7.8 g/cc) with diameters from 250m to 10 km. In our three-dimensional runs we simulated asteroids of 1 km diameter composed of iron moving at 20 km/s at angles of 45 and 60 degrees from the vertical. All impacts, including the oblique ones, produce large underwater cavities with nearly vertical walls followed by a collapse starting from the bottom and subsequent vertical jetting.

Substantial amounts of water are vaporized and lofted high into the atmosphere. In the larger impacts, significant amounts of crustal and even mantle material are lofted as well. Tsunamis up to a kilometer in initial height are generated by the collapse of the vertical jet. These waves are initially complex in form, and interact strongly with shocks propagating through the water and the crust. The tsunami waves are followed out to 100 km from the point of impact. Their periods and wavelengths show them to be intermediate type waves, and not (in general) shallow-water waves. At great distances, the waves decay faster than the inverse of the distance from the impact point, ignoring sea-floor topography. For all impactors smaller than about 2 km diameter, the impacting body is highly fragmented and its remains lofted into the stratosphere with the water vapor and crustal material, hence very little trace of the impacting body should be found for most oceanic impacts. In the oblique impacts, the initial asymmetry of the transient crater and crown does not persist beyond a tsunami propagation length of 50 km.

Author

*Three Dimensional Models; Two Dimensional Models; Asteroids; Simulation; Impactors; Oceans*

**20030014869** Oxford Brookes Univ., BMS, Headington, UK

**Early Fracturing and Impact Residue Emplacement: Can Modeling Help to Predict Their Location in Major Craters?**

Kearsley, A. T., Oxford Brookes Univ., UK; Graham, G. A., Open Univ., UK; McDonnell, J. A. M., Open Univ., UK; Bland, P. A., Imperial Coll. of Science, Technology and Medicine, UK; Hough, R. M., Western Australian Museum, Australia; Helps, P. A., Kingston Univ., UK; Impact Cratering: Bridging the Gap Between Modeling and Observations; 2003, pp. 43; In English; Also announced as 20030014839; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The nature of the extraterrestrial bodies that created some terrestrial impact craters has been determined by collection of disrupted and shocked impactor fragments (e.g. the well-known iron meteorite Canyon Diablo from the vicinity of Barringer Crater, Arizona). In other cases, finding sufficient chemical residue from the bolide for diagnostic analysis has proven more difficult, yet modern trace-element and particularly isotopic analyses have been successfully employed, e.g. The big question is often: "In a limited field investigation, where should we look?"

Author

*Impactors; Residues; Craters; Fracturing; Fragments; Models*

**20030014874** Arizona Univ., Lunar and Planetary Lab., Tucson, AZ USA

**Modeling Meteorite Impacts: What We Know and What We Would Like to Know**

Melosh, H. J., Arizona Univ., USA; Impact Cratering: Bridging the Gap Between Modeling and Observations; 2003, pp. 49-50; In English; Also announced as 20030014839; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Meteorite impacts can be studied by computer simulation: Large meteorite impacts are among those phenomena that are either too large or too dangerous to study experimentally. Although impacts have affected the formation and surfaces of nearly every body in the solar system, we are limited to observing the results of past events. Investigation of impact processes is thus divided into observational studies of the traces of past impacts, small-scale analogue laboratory experiments and, most recently, detailed computer modeling. Computer models offer the possibility of studying craters at all scales, provided we completely understand the physics of the process and possess enough computer power to simulate the features of interest.

Author

*Meteorite Collisions; Impact; Mathematical Models; Analogs*

**20030015195** Hawaii Univ., Inst. for Astronomy, Honolulu, HI USA

**Physical Properties of Cometary Nucleus Candidates *Annual Report, 1 Mar. 2002 - 29 Feb. 2003***

Jewitt, David, Hawaii Univ., USA; [2003]; 5p; In English

Contract(s)/Grant(s): NAG5-10437; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

In this proposal we aim to study the physical properties of the Centaurs and the dead comets, these being the precursors to, and the remnants from, the active cometary nuclei. The nuclei themselves are very difficult to study, because of the contaminating effects of near-nucleus coma. Systematic investigation of the nuclei both before they enter the zone of strong sublimation and after they have depleted their near-surface volatiles should neatly bracket the properties of these objects, revealing evolutionary effects.

Author

*Comet Nuclei; Physical Properties*

**20030015719** Extrasolar Research Corp., Pasadena, CA USA

**The Contribution of Ionizing Stars to the Far-Infrared and Radio Emission in the Milky Way: Evidence for a Swept-up Shell and Diffuse Ionized Halo Around the W4 Chimney/Supershell *Final Report, Jan. 1997 - Dec. 1999***

Terebey, Susan, Extrasolar Research Corp., USA; Dec. 18, 1999; 21p; In English

Contract(s)/Grant(s): NAS5-97066; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Normandeau have proposed that W4 is a galactic chimney, the only chimney to-date identified in our Galaxy. Using the recent approx. 1 min resolution IGA (Infrared Galaxy Atlas) and DRAO (Dominion Royal Astrophysical Observatory) CGPS (Canadian Galactic Plane Survey) galactic plane surveys we analyze the far-infrared and radio structure of the W 4 chimney/supershell. We show W4 has a swept-up partially ionized shell of gas and dust which is powered by the OC1 352 star cluster. Analysis of the dust column density establishes there is dense interstellar material below the shell, directly showing the dense material which caused the lower shell expansion to stall. Due to much lower densities above the Galactic plane, the upper W4 shell achieved 'breakout' to form a Galactic chimney. Although the shell appears ionization bounded, it is very inhomogenous and an ionized halo provides evidence of significant Lyman continuum leakage. A large fraction of the OC1 352 cluster photons escape to large distances and are available to ionize the WIM (warm ionized medium) component of the interstellar medium.

Author

*Ionization; Infrared Astronomy; Radio Astronomy; Far Infrared Radiation; Radio Emission; Interstellar Matter*

**20030015720** Smithsonian Astrophysical Observatory, Cambridge, MA USA

**Non-Radiative Shocks in The Cygnus Loop: H2 in HH2 Fluorescence or Collisions? *Final Report, 1 Feb. 2000 - 31 Jan. 2003***

Raymond, John C., Smithsonian Astrophysical Observatory, USA; January 2003; 1p; In English

Contract(s)/Grant(s): NAG5-9019; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The FUSE observations of a non-radiative shock wave in the Cygnus Loop were obtained in June and October 2000. The two main results were near equilibration of the kinetic temperature of oxygen with protons and electrons and inferred 3D structure and pre-shock density for the shock including resonance scattering. The 3D structure in turn implies density fluctuations in keeping with the level expected for interstellar turbulence. Major results are contained in an ApJ paper in press and some extensions are contained in a conference proceedings paper in Rev. Mex. A&A in press. Very early results were given in the Ghavamian et al. paper in 2000. The observations of HH2 have not yet been obtained due to the pointing constraints of FUSE. They were scheduled for early January 2003, but we have not yet received the processed data. We are hoping to get the data shortly.

Author

*Cygnus Constellation; Hydrogen; Shock Waves; Resonance Scattering; Interstellar Matter; Space Density*

**20030016512** California Inst. of Tech., Dept. of Geological and Planetary Sciences, Pasadena, CA USA

**Experimental and Analytical Studies of Solar System Chemistry *Final Report***

Burnett, Donald S., California Inst. of Tech., USA; February 2003; 5p; In English

Contract(s)/Grant(s): NAG5-4319; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The cosmochemistry research funded by this grant resulted in the publications given in the attached Publication List. The research focused in three areas: (1) Experimental studies of trace element partitioning. (2) Studies of the minor element chemistry and O isotopic compositions of MgAlO<sub>4</sub> spinels from Ca-Al-Rich Inclusions in carbonaceous chondrite meteorites, and (3) The abundances and chemical fractionations of Th and U in chondritic meteorites.

Author

*Trace Elements; Oxygen Isotopes; Spinel; Carbonaceous Chondrites; Meteoritic Composition*

**20030016568** Smithsonian Astrophysical Observatory, Cambridge, MA USA

**Spectroscopic Determination of the Physical Conditions in Hot Optically Thin Sources *Annual Report, 1 Jan. - 31 Dec. 2002***

Brickhouse, Nancy, Smithsonian Astrophysical Observatory, USA; January 2003; 4p; In English

Contract(s)/Grant(s): NAG5-3559; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The Astrophysics Plasma Emission Code and Database (APEC/APED), developed in part under this grant, have been upgraded to Version 1.3.0 and are now beginning to find widespread applications to X-ray spectral data from Chandra and XMM-Newton. These models represent the best theoretical data currently available and are reasonably complete below about 30 Å. We are making significant progress in improving the spectral models between 30 and 90 Å, by the addition of HULLAC calculations and NIST wavelengths for L-shell ions of Ne, Mg, Si, S, Ar, and Ca. While the output models are now public, the code itself is not ready for public release. We have made significant progress toward this goal through programming

improvements, including optimized error codes, a major (elusive) bug fix, and additions to our testing protocols. Secondly, we are beginning to investigate limited uses of APEC for X-ray photoionized plasma, as for opacity modeling. Stellar coronae are being used to benchmark the atomic data in APED as part of the Emission Line Project. The models appear to be in good agreement with the observations for most of the strong lines; however, we have identified significant discrepancies in the 3s/3d line ratios not only for Fe XVII, but also for Fe XVIII and XIX. The careful analysis of these high quality X-ray spectra has also shown that there are serious problems with some of the analysis techniques in widespread use. There are several manifestations of the problem, but the main problem is that line-to-continuum ratios may be seriously mismeasured. We continue to collaborate widely with atomic physicists in order to find the best atomic data, and to solicit calculations and measurements that are needed.

Derived from text

*Astrophysics; Atoms; Emission Spectra; Plasma Radiation; Plasmas (Physics); Spectroscopy; X Ray Spectra; X Ray Spectroscopy*

**20030016574** Lawrence Livermore National Lab., Livermore, CA USA

**X-Ray Spectra of VY Scl Stars Are Not Blackbodies**

Mauche, C. W.; Mukai, K.; Dec. 10, 2001; 16p; In English

Report No.(s): DE2002-801762; UCRL-JC-146507; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Using ASCA data, we find, contrary to other researchers using ROSAT data, that the X, ray spectra of the VY Scl stars TT Ari and KR Aur are poorly fit by an absorbed blackbody model but are well fit by an absorbed thermal plasma model. The different conclusions about the nature of the X-ray spectrum of KR Aur may be due to differences in the accretion rate, since this star was in a high optical state during the ROSAT observation, but in an intermediate optical state during the ASCA observation. TT Ari, on the other hand, was in a high optical state during both observations, so directly contradicts the hypothesis that the X-ray spectra of VY Sol stars in their high optical states are blackbodies. Instead, based on theoretical expectations and the ASCA, Chandra, and XMM spectra of other nonmagnetic cataclysmic variables, we believe that the X-ray spectra of VY Sol stars in their low and high optical states are due to hot thermal plasma in the boundary layer between the accretion disk and the surface of the white dwarf, and appeal to the acquisition of Chandra and XMM grating spectra to test this prediction.

NTIS

*X Ray Spectra; Stars; Stellar Spectra; Accretion Disks*

**20030016609** Space Telescope Science Inst., Baltimore, MD USA

**Post-AGB Stars in Nearby Galaxies as Calibrators for HST Final Report, 1 Jan. 1998 - 31 Dec. 2001**

Bond, Howard E., Space Telescope Science Inst., USA; [2003]; 9p; In English

Contract(s)/Grant(s): NAG5-6821; STScI Proj. J0133; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

This report summarizes activities carried out with support from the NASA Ultraviolet, Visible, and Gravitational Astrophysics Research and Analysis Program under Grant NAG 5-6821. The Principal Investigator is Howard E. Bond (Space Telescope Science Institute). STScI Postdoctoral Associates Laura K. Fullton (1998), David Alves (1998-2001), and Michael Siegel (2001) were partially supported by this grant. The aim of the program is to calibrate the absolute magnitudes of post-asymptotic-giant-branch (post-AGB or PAGB) stars, which we believe will be an excellent new "standard candle" for measuring extragalactic distances. The argument is that, in old populations, the stars that are evolving through the PAGB region of the HR diagram arise from only a single main-sequence turnoff mass. In addition, theoretical PAGB evolutionary tracks show that they evolve through this region at constant luminosity; hence the PAGB stars should have an extremely narrow luminosity function. Moreover, as the PAGB stars evolve through spectral types F and A (en route from the AGB to hot stellar remnants and white dwarfs), they have the highest luminosities attained by old stars (both bolometrically and in the visual band). Finally, PAGB stars of these spectral types are very easily identified, because of their large Balmer jumps, which are due to their very low surface gravities. Our approach is first to identify PAGB stars in Milky Way globular clusters and in other Local Group galaxies, which are at known distances, and thus to measure accurate absolute magnitudes for the PAGB stars. With this Milky Way and Local Group luminosity calibration, we will then be in a position to find PAGB stars in more distant galaxies from the ground, and ultimately from the Hubble Space Telescope, and thus derive distances. These PAGB stars are, as noted above, the visually brightest members of Population II, and hence will allow distance measurements to galaxies that do not contain Cepheids, such as elliptical galaxies, as well as distances to spirals using PAGB stars in their halos. Moreover, the method is entirely independent of Cepheids, and thus provides a direct test of the Cepheid distance scale. The program will also provide information on the evolutionary lifetimes of PAGB stars.

Derived from text

*Asymptotic Giant Branch Stars; Astrophysics; Calibrating; Distance*

**20030016675** Space Telescope Science Inst., Baltimore, MD USA

**An X-ray Luminous, Distant ( $z=0.78$ ) Cluster of Galaxies Final Report, 15 Aug. 1997- 14 Aug. 2001**

Donahue, Megan, Space Telescope Science Inst., USA; [2001]; 6p; In English

Contract(s)/Grant(s): NAG5-6236; STScI Proj. J0567; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

This granted funded ASCA studies of the most X-ray luminous clusters of galaxies in the Extended Medium Sensitivity Survey. These studies leveraged further observations with Chandra and sparked a new collaboration between the PI and John Carlstrom's Sunyaev-Zel'dovich team. The major scientific results due largely or in part from these observations: the first  $z=0.5-0.8$  cluster temperature function, constraints on cluster evolution which showed definitively that the density of the universe divided by the critical density,  $\Omega_m$ , could not be 1.0, constraints on cluster evolution limiting  $\Omega_m$  to 0.2-0.5, independent of  $\lambda$ , the first detections of intracluster iron in a  $z>0.6$  cluster of galaxies. These results are independent of the supernova and cosmological microwave background results, and provide independent constraint on cosmological parameters.

Author

*Galactic Clusters; X Ray Sources; Background Radiation; Supernovae*

**20030016676** Space Telescope Science Inst., Baltimore, MD USA

**The Evolution of Disks and Winds in Dwarf Nova Outbursts - FUSE Final Report, 15 Apr. 1999 - 14 Apr. 2002**

Long, Knox, Space Telescope Science Inst., USA; Oct. 28, 2002; 7p; In English

Contract(s)/Grant(s): NAG5-9283; STScI Proj. J0248; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

This project was a project to study the FUV spectra of two proto-typical dwarf novae, U Gem and SS Cygni, through an outburst cycle. The luminosity of the boundary layer in the two systems, as evidenced by earlier EUVE observations, is different in the two systems. Our intensive study of the two systems was intended to (1) probe the ionization and kinematic structure of the wind as a function of system brightness, (2) isolate the contributions of the disk to the FUV spectra, and (3) examine physical conditions and abundances of material just being accreted onto the disk from the secondary. The U Gem and SS Cyg observations took place in March and October 2000, respectively. The data obtained with FUSE was of excellent quality. Analysis of the both observations is now essentially complete, although some modeling of the SS Cyg spectra is ongoing, as we complete an ApJ manuscript on this object. Our main results for U Gem are as follows: The plateau spectra have continuum shapes and fluxes that are approximated by steady state accretion disk model spectra with an accretion rate  $7 \times 10^{(exp 9)}$  Msolar/yr. The spectra also show numerous absorption lines of H I, He II, and 2-5 times ionized transitions of C, N, O, P, S, and Si. There are no emission features in the spectra, with the possible exception of a weak feature on the red wing of the O VI doublet. The absorption lines are narrow (FWHM approx. 50 km/s), too narrow to arise from the disk photosphere, and at low velocities (less than or equal to 700 km/s). The S VI and O VI doublets are optically thick. The absorption lines in the plateau spectra show orbital variability: in spectra obtained at orbital phases between 0.53 and 0.79, low-ionization absorption lines appear and the central depths of the preexisting lines increase. The increase in line absorption occurs at the same orbital phases as previously observed EUV and X-ray light-curve dips. If the absorbing material is in (near-) Keplerian rotation around the disk, it must be located at large disk radii. The final observation occurred when U Gem was about 2 mag from optical quiescence. The spectra are dominated by emission from an approx. 43,000 K, metal-enriched white dwarf (WD). The inferred radius of the WD is  $4.95 \times 10^{(exp 8)}$  cm, close to that observed in quiescence. Allowing for a hot heated region on the surface of the WD improves the fit to the spectrum at short (less than 960 Å) wavelengths. Our main results for SS Cyg are as follows: The first two of four observations of SS Cyg show disk dominated spectra with accretion rates of order  $10^{(exp -8)}$  Msolar/yr. Except for narrow interstellar features (atomic and molecular H), the lines are all broad consistent with a disk or wind origin. The O VI line in the spectra is mostly of wind origin as detailed modeling with our Monte Carlo code (developed in part using funds from this project) show. The continua from spectra in observations 3 and 4, observed during the decline phase, are not well fit with steady-state disks, and show considerable resemblance to quiescent spectra obtained with HUT. The most probable interpretation for the emission features seen in the spectrum in the last two observations is that they arise from a photo-illuminated choronosphere above the disk, rather than a wind.

Author

*Luminosity; Dwarf Novae; Extreme Ultraviolet Radiation; Kinematics; Ionization; Brightness*

**20030017828** Shanghai Astronomical Observatory, China

**A Keplerian Model of the Gas Molecular Ring in the Center of Our Galaxy**

Fu, Cheng-Qi, Shanghai Astronomical Observatory, China; Annals of Shanghai Observatory, Academia Sinica; 2002, No. 23, pp. 52-60; In Chinese; ISBN 7-5323-6796-7; Copyright; Avail: Issuing Activity

Based on the survey observations for CO lines in the center of our Galaxy, this paper presents a keplerian model for the 300pc gas molecular ring: a expending or infalling elliptic ring on which gas molecular clouds rotates according to Kepler's law. by this

model, we can get the radial velocity - galactic longitude pattern produced by radiation from the gas molecular in the ring which is like the CO observations. This paper also discuss the effects of model parameters on the pattern.

Author

*Galaxies; Longitude; Molecular Clouds; Radial Velocity*

**20030017830** Smithsonian Astrophysical Observatory, Cambridge, MA USA

**Uncovering The Properties of Young Neutron Stars and Their Surrounding Supernova A Remnants** *Annual Report, 1 Apr. 2002 - 31 Mar. 2003*

Slane, Patrick O., Smithsonian Astrophysical Observatory, USA; February 2003; 2p; In English

Contract(s)/Grant(s): NAG5-9281

Report No.(s): Rept-3; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

In the third year of this program, the following studies have been undertaken in support of this effort: G292.0+1.8: In our previous work on this SNR, we discovered a young neutron star and its associated pulsar wind nebula. Radio observations by Camilo et al. (2002) have identified a young 136 ms pulsar in the direction of G292.0+1.8. We have used Chandra HRC observations of the central source to identify X-ray pulsations at the same period, thus establishing the neutron star as the radio pulsar counterpart. We have also set limits on the cooling of this young neutron star based on the unpulsed component of the X-ray emission. We find that the limit falls slightly below standard cooling models in which the modified Urca process is responsible for the bulk of the interior neutrino emission. A paper summarizing these results is currently being circulated amongst co-authors for review prior to publication. 3c 58: Our Chandra observations of this Crab-like SNR revealed the presence of a young, rapidly rotating pulsar as well as a central compact nebula which we interpret as a toroidal structure associated with the pulsar wind termination shock. Our modeling of this structure has allowed us to establish a temperature upper limit for the neutron star which falls well below predictions from standard cooling models, and implies the presence of exotic particles (such as pion condensates) or other processes that increase the neutrino production rate in the interior. A paper summarizing this work has been published in the *Astrophysical Journal* (Slane, Helfand, & Murray 2002, *ApJ*, 571, L45), and the results were the subject of a NASA Space Science Update (4/10/2002) which led to extensive media coverage. Based upon our initial observations, we submitted a successful Chandra Large Project proposal for a 350 ks observation of this young neutron star and its wind nebula. Kes 79: Our Chandra observations of this SNR reveal a compact central source which appears to be the neutron star formed in the explosion that produced the remnant. There is no evidence for a surrounding pulsar wind nebula. The source properties are similar to the central source in Cas A even though the Kes 79 remnant is considerably older. The results have been published in the *Astrophysical Journal* (Seward, Slane, Smith, and Sun 2003, *ApJ*, 584,414). Chandra Survey for Compact Objects in Supernova Remnants: We have formed a collaboration to carry out an extensive search for young neutron stars in nearby supernova remnants. Using X-ray observations from an approved Chandra Large Project, as well as from additional approved XMM observations, we are investigating a volume-limited sample of SNRs for which there is currently no evidence of associated neutron stars. We have obtained extensive optical and IR data to complement the project, and analysis of these data is currently underway.

Derived from text

*Supernova Remnants; Neutron Stars; Radio Observation; Pulsars*

**20030017835** Smithsonian Astrophysical Observatory, Cambridge, MA USA

**The Star Formation History of Orion and its Environs** *Annual Report, 15 Mar. 2002 - 14 Mar. 2003*

Calvet, Nuria, Smithsonian Astrophysical Observatory, USA; February 2003; 4p; In English

Contract(s)/Grant(s): NAG5-10545

Report No.(s): Rept-2; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

During the period of performance, we have obtained the following observations and carried out the analysis of the Orion associations itemized below. Optical Photometry: The Quest camera that had been damaged by lightning on Sept. 2001 was reconfigured to use 10 chips and only 3 filters instead of the original 4 but retaining its spatial coverage of 2.3deg wide in declination. During the Winter and Fall 2002 observing campaigns, we obtained multifilter photometry using the Quest camera on the 1mt Schmidt of the Venezuelan National Observatory, to continue the survey of the Orion clouds. In the Winter 2002 season, we obtained photometry for 10 scans at DEC=+5, 7 scans at DEC=-5. Several additional scans at DEC=-3 were obtained during the Fall 2002 observing campaign. Slit spectroscopy of bright candidates: During 2002 spectra for some 235 candidate PMS stars were obtained with the FAST spectrograph at the SAO 1.5m telescope in Mt. Hopkins. These objects, all brighter than V=16, are located in two strips centered at DEC=+1 and -5, and spanning from RA=5h-6h. The spectra are being analyzed. Multifiber spectroscopy: Spectroscopy for our fainter (V less than or equal to 16) candidates has not kept pace with our spectroscopy of brighter candidates, because of the delay in the commissioning of the Hectospec and Hectoechelle multi-object spectrographs at the new 6.5m MMT. We obtained some data with the Hydra spectrograph on the WIYN telescope: Feb 1-4, 2002. Time granted

to the project: "A Large Scale Survey of the Low-Mass Young Population in the Orion OB1 Association" (P.I.: C. Briceno). Three half-nights (we used the first half of the night, the second half of the night was used with the Mini-Mosaic imager by another team). Only the first half night was clear. We observed 3 fields centered in a 2.3 deg wide strip centered at DEC=-1 and spanning RA=5h to 6h. A total of 250 spectra were obtained for the same number of candidate PMS stars. Nov. 13-15, 2002. Time granted to the project "Cluster survey of protoplanetary disk evolution", (P.I.: A. Sicilia-Aguilar). Clear weather throughout. We obtained spectra for some 200 candidate PMS stars in 3 fields located in a 2.3 deg wide strip centered at DEC=+1 and spanning from RA=5h20m to 5h35m. Data for both observing runs is partially reduced and is being analyzed. U photometry: During Nov.29-Dec.4, 2002 we were granted time with the 4-shooter CCD Mosaic Camera at the SAO 1.2m telescope, to obtain U-band photometry of a subset of the newly identified T Tauri stars in the strip centered at DEC=-1. This sample is composed of strong H(alpha) emitting PMS stars (Classical T Tauri stars) located mostly in the Orion OB 1b association, around the Orion Belt area. Our data will be combined with our calibration of the U-band excess (Gullbring et al. 1998) to derive mass accretion rates. Because of bad weather we observed only 20 stars during 1.5 clear nights. Near IR photometry: During Dec. 14-19, 2002 we used the IR Camera on the SAO 1.2m telescope, to obtain L-band photometry of a set of 17 the newly identified Orion OB 1a and 1b stars, in order to look for IR excess emission coming from the hotter inner parts of circumstellar disks. Again, mediocre weather prevented a larger set to be observed. These stars were also observed with the OSCIR mid-IR camera on Gemini North during later 2001. Our goal is to construct SEDs from the visual out to the mid-IR (by combining our optical/IR data with 2MASS JHK magnitudes) in order to explore disk dissipation at the critical ages of 5-10 Myr spanned by these stars.

Derived from text

*Star Formation; O Stars; Star Clusters; Pre-Main Sequence Stars; Near Infrared Radiation*

**20030017839** NASA Marshall Space Flight Center, Huntsville, AL USA

**Statistical Properties of Maximum Likelihood Estimators of Power Law Spectra Information**

Howell, L. W., NASA Marshall Space Flight Center, USA; December 2002; 64p; In English

Report No.(s): NASA/TP-2002-212020/REV1; NAS 1.60:212020/REV1; M-1056; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

A simple power law model consisting of a single spectral index,  $\alpha_1$ , is believed to be an adequate description of the galactic cosmic-ray (GCR) proton flux energies below  $10(\exp 13)$  eV, with a transition at the knee energy,  $E_k$ , to a steeper spectral index  $\alpha_2$  is greater than  $\alpha_1$ , above  $E_k$ . The maximum likelihood (ML) procedure was developed for estimating the single parameter  $\alpha_1$ , of a simple power law energy spectrum and generalized to estimate the three spectral parameters of the broken power law energy spectrum from simulated detector responses and real cosmic-ray data. The statistical properties of the ML estimator were investigated and shown to have the three desirable properties: (P1) consistency (asymptotically unbiased), (P2) efficiency (asymptotically attains the Cramer-Rao minimum variance bound), and (P3) asymptotically normally distributed, under a wide range of potential detector response functions. Attainment of these properties necessarily implies that the ML estimation procedure provides the best unbiased estimator possible. While simulation studies can easily determine if a given estimation procedure provides an unbiased estimate of the spectra information, and whether or not the estimator is approximately normally distributed, attainment of the Cramer-Rao bound (CRB) can only be ascertained by calculating the CRB for an assumed energy spectrum-detector response function combination, which can be quite formidable in practice. However, the effort in calculating the CRB is very worthwhile because it provides the necessary means to compare the efficiency of competing estimation techniques and, furthermore, provides a stopping rule in the search for the best unbiased estimator. Consequently, the CRB for both the simple and broken power law energy spectra are derived herein and the condition under which they are attained in practice are investigated. The ML technique is then extended to estimate spectra information from an arbitrary number of astrophysics data sets produced by vastly different science instruments. This theory and its successful implementation will facilitate the interpretation of spectral information from multiple astrophysics missions and thereby permit the derivation of superior spectral parameter estimates based on the combination of data sets.

Author

*Cosmic Rays; Maximum Likelihood Estimates; Spectrum Analysis; Energy Spectra; Power Spectra*

**20030017991** NASA Ames Research Center, Moffett Field, CA USA

**High Abundance of Ions in Cosmic Ices**

Gudipati, Murthy S., Maryland Univ., USA; Allamandola, Louis J., NASA Ames Research Center, USA; Dec. 10, 2002; 14p; In English

Contract(s)/Grant(s): RTOP 344-89-02-23; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Water-rich, mixed molecular ices and polycyclic aromatic hydrocarbons (PAHs) are common throughout interstellar molecular clouds and the Solar System. Vacuum ultraviolet (VUV) irradiation and particle bombardment of these abiotic ices

produces complex organic species, including important biogenic molecules such as amino acids and functionalized PAHs which may have played a role in the origin of life. This ability of such water-rich, oxygen dominated ices to promote production of complex organic species is surprising and points to an important, unusual, but previously overlooked mechanism at play within the ice. Here we report the nature of this mechanism using electronic spectroscopy. VUV-irradiation of PAH/H<sub>2</sub>O ices leads to an unprecedented and efficient (greater than 70 %) conversion of the neutral PAHs to their cation form (PAH<sup>+</sup>). Further, these H<sub>2</sub>O/PAH<sup>+</sup> ices are stable at temperatures below 50 K, a temperature domain common throughout interstellar clouds and the Solar System. Between 50 and 125 K they react to form the complex organics. In view of this, we conclude that charged PAHs and other molecular ions should be common and abundant in many cosmic ices. The chemical, spectroscopic and physical properties of these ion-rich ices can be of fundamental importance for objects as diverse as comets, planets, and molecular clouds and may account for several poorly understood phenomena associated with each of these object classes.

Author

*Ions; Ice; Polycyclic Aromatic Hydrocarbons; Interstellar Matter; Spectroscopy; Composition (Property)*

**20030018100** Smithsonian Astrophysical Observatory, Cambridge, MA USA

**Research on Spectroscopy, Opacity, and Atmospheres Annual Report, 15 May 2002 - 14 May 2003**

Kurucz, Robert L., Smithsonian Astrophysical Observatory, USA; February 2003; 30p; In English

Contract(s)/Grant(s): NAG5-10864; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

For planetary and telluric atmosphere projects the solar irradiance spectrum is required as the input at the top of the atmosphere. It has never been observed. People ask me to compute it. I can compute it theoretically using both known and predicted lines and get agreement averaged over a nanometer but there is no way to predict the resolved spectrum when only half the lines are known. In other stars the situation is worse because the signal-to-noise and resolution of the observations are worse. Logically one has to know a priori what is in the spectrum in order to interpret it; there is not enough information in the observed spectrum itself (qualifiers are given). Basically we need a list of all the energy levels of all atoms and molecules that matter. From that list can be generated all the lines. With the energy levels and line positions known, one can measure gf values, lifetimes, damping, or one can determine a theoretical or semiempirical Hamiltonian whose eigenvalues and eigenvectors produce a good match to the observed data, and that can then be used to generate additional radiative and collisional data for atoms or molecules.

Derived from text

*Opacity; Planetary Atmospheres; Spectroscopy; Telluric Lines; Solar Radiation*

**20030018102** Northwestern Univ., Dept. of Physics and Astronomy, Evanston, IL USA

**Theoretical Studies of Accreting Neutron Stars Final Report**

Taam, Ronald E., Northwestern Univ., USA; [2003]; 4p; In English

Contract(s)/Grant(s): NAG5-7011; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Among the newly discovered classes of X-ray sources which have attracted wide attention are close binary systems in which mass is transferred via Roche lobe overflow from a low mass donor star to its neutron star companion. Many of these sources exhibit intense bursts of X-ray radiation as well as periodic and quasi-periodic phenomena. Intensive analysis of these sources as a class has provided insight into the accretion process in binary star systems and into the magnetic field, rotational, and nuclear evolution of the underlying neutron star. In this proposal we have focused on theoretical studies of the hydrodynamical and nuclear processes that take place on the surface of accreting neutron stars in these systems. The investigation of these processes is critical for providing an understanding of a number of outstanding problems related to their transient behavior and evolution.

Derived from text

*Neutron Stars; Magnetic Fields; X Ray Sources; Deposition*

**20030018256** Smithsonian Astrophysical Observatory, Cambridge, MA USA

**Environmental Effects on the Metallicities of Early-Type Galaxies Annual Report, 29 Jan. 2002 - 28 Jan. 2003**

Jones, Christine, Smithsonian Astrophysical Observatory, USA; February 2003; 1p; In English

Contract(s)/Grant(s): NAG5-9096; No Copyright; Avail: Issuing Activity; Abstract Only

We have completed and published two papers based on research from this grant. Our first paper "SN Ia Enrichment in Virgo Early-type Galaxies from ROSAT and ASCA Observations" was published in the *Astrophysical Journal* (vol 539,603) reported on the properties of nine X-ray bright elliptical galaxies in the Virgo cluster observed by ROSAT and ASCA. We measured iron abundance gradients as a function of radius in three galaxies. We found that the magnesium and silicon abundance gradients were in general flatter than those of iron. We suggest this is due to a metallicity dependence in the metal production rates of SN Ia's. We calculate SN Ia rates in the center of these galaxies that are comparable to those measured optically. Our second paper "ASCA Observations of Groups at Radii of Low Overdensity: Implications for Cosmic Preheating" also was published in the

Astrophysical Journal (vol 578, 74). This paper reported on the ASCA spectroscopy of nine groups of galaxies. We found that the entropy profile in groups is driven by nongravitational heating processes, and could be explained by a short period of preheating by galactic winds.

Author

*Metallicity; Environment Effects; Virgo Galactic Cluster; X Ray Sources; Elliptical Galaxies*

**20030018446** Smithsonian Astrophysical Observatory, Cambridge, MA USA

**The Mass of the Classical Cepheid S Mus Annual Report, 1 Apr. 2002 - 31 Mar. 2003**

Evans, Nancy, Smithsonian Astrophysical Observatory, USA; February 2003; 1p; In English

Contract(s)/Grant(s): NAG5-11946; No Copyright; Avail: Issuing Activity; Abstract Only

This program was to obtain a FUSE satellite spectrum of the classical Cepheid S Mus. The aim was to determine the temperature of the hot companion. Combining this with orbital velocity data, the mass of the Cepheid can be obtained. The spectrum was obtained in spring, 2002. Preliminary reductions have been done, which confirm the results from the lower resolution Voyager spectrum. Final reductions are in progress.

Author

*Cepheid Variables; Stellar Mass; Astrophysics; Spectra*

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### LUNAR AND PLANETARY SCIENCE AND EXPLORATION

*Includes planetology; selenology; meteorites; comets; and manned and unmanned planetary and lunar flights. For spacecraft design or space stations see 18 Spacecraft Design, Testing and Performance.*

**20030014741** NASA Ames Research Center, Moffett Field, CA USA

**The Mars Exploration Rover/Collaborative Information Portal**

Walton, Joan, NASA Ames Research Center, USA; Filman, Robert E., Research Inst. for Advanced Computer Science, USA; Schreiner, John, NASA Ames Research Center, USA; Oct. 31, 2002; 6p; In English; 10th International Conference on Human-Computer Interaction, 22-27 Jun. 2003, Crete, Greece; Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche; Distribution as joint owner in the copyright; Distribution as joint owner in the copyright

Astrology has long argued that the alignment of the planets governs human affairs. Science usually scoffs at this. There is, however, an important exception: sending spacecraft for planetary exploration. In late May and early June, 2003, Mars will be in position for Earth launch. Two Mars Exploration Rovers (MER) will rocket towards the red planet. The rovers will perform a series of geological and meteorological experiments, seeking to examine geological evidence for water and conditions once favorable for life. Back on earth, a small army of surface operations staff will work to keep the rovers running, sending directions for each day's operations and receiving the files encoding the outputs of the Rover's six instruments. (Mars is twenty light minutes from Earth. The rovers must be robots.) The fundamental purpose of the project is, after all, Science. Scientists have experiments they want to run. Ideally, scientists want to be immediately notified when the data products of their experiments have been received, so that they can examine their data and (collaboratively) deduce results. Mars is an unpredictable environment. We may issue commands to the rovers but there is considerable uncertainty in how the commands will be executed and whether what the rovers sense will be worthy of further pursuit. The steps of what is, to a scientist, conceptually an individual experiment may be scattered over a large number of activities. While the scientific staff has an overall strategic idea of what it would like to accomplish, activities are planned daily. The data and surprises of the previous day need to be integrated into the negotiations for the next day's activities, all synchronized to a schedule of transmission windows. Negotiations is the operative term, as different scientists want the resources to run possibly incompatible experiments. Many meetings plan each day's activities.

Author

*Mars Exploration; Space Exploration; Roving Vehicles; Geology*

**20030014839** Lunar and Planetary Inst., Houston, TX USA

**Impact Cratering: Bridging the Gap Between Modeling and Observations**

2003; ISSN 0161-5297; 80p; In English, 7-9 Feb. 2003, Houston, TX, USA; Sponsored by Lunar and Planetary Inst., USA; Also announced as 20030014840 through 20030014890

Contract(s)/Grant(s): NCC5-679

Report No.(s): LPI-Contrib-1155; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

This volume contains abstracts that have been accepted for presentation at the workshop on Impact Cratering: Bridging the Gap Between Modeling and Observations, February 7-9, 2003, in Houston, Texas. Logistics, onsite administration, and publications for this workshop were provided by the staff of the Publications and Program Services Department at the Lunar and Planetary Institute.

Author

*Conferences; Models; Seismic Waves; Craters; Meteorite Collisions*

**20030014840** California Inst. of Tech., Lindhurst Lab. of Experimental Geophysics, Pasadena, CA USA

**Calculation of Planetary Impact Cratering to Late Times**

Ahrens, Thomas J., California Inst. of Tech., USA; OKeefe, John D., California Inst. of Tech., USA; Stewart, Sarah T., Carnegie Institution of Washington, USA; Impact Cratering: Bridging the Gap Between Modeling and Observations; 2003, pp. 7; In English; Also announced as 20030014839; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Simulation of impact cratering on planetary materials is crucially dependent on adequate description of shock processing of surface materials. Two recent examples of the importance of these processes is demonstrated by the simulation of impact induced flow from the impact of a ca. 10 km bolide at 20 km/sec onto the Earth. This has been inferred to have occurred along the Yucatan (Mexican) coast, 65 million years ago. This impact is inferred to have triggered global climatic change, induced by the impact devolatilization of the marine anhydrite ( $\text{CaSiO}_4$ ) and gypsum ( $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$ ) deposits of the target rocks. These calculations conducted with Sandia's CTH code depend crucially upon utilizing a rock damage model which reduced crustal rock strength from 100 MPa to 1 MPa over a volume some 102 times that of the bolide in about 1 minute and gives rise to a 100 km diameter central peak, flat-floored crater with overturned target flap some 8 minutes after impact. Comparison of calculated post-impact deformation compares favorably with seismic profiling and drill-core data. A second example is the formation of ejecta blankets giving rise to rampart Martian craters by fluidization with liquid water by a new impact cratering simulation and recent shock wave data on  $\text{H}_2\text{O}$  ice. We demonstrate that ground ice is melted by the impact shock within a hemisphere of radius equal to the final crater radius, resulting in excavation of a mixture of liquid water and brecciated rock into the continuous ejecta blanket. Our shock wave experiments demonstrate that ice at Mars temperature, 150 to 275 K, will begin to melt when shocked above 2.2 to 0.6 GPa, respectively, lower than previously expected. Hence, the presence of liquid water near the pre-impacted surface is not required to form fluidized ejecta. The amount of ice melted and incorporated into the ejecta blanket debris flow is within a factor of two of the subsurface ice content; therefore, debris flow modeling of fluidized ejecta morphologies may be used to quantify the amount of near-surface ground ice on Mars.

Author

*Computation; Impact Strength; Cratering; Deformation; Mars Craters; Planets*

**20030014841** California Inst. of Tech., Pasadena, CA USA

**Dynamic Tensile Strength of Crustal Rocks and Application to Impact Cratering**

Ai, H., California Inst. of Tech., USA; Ahrens, T. J., California Inst. of Tech., USA; Impact Cratering: Bridging the Gap Between Modeling and Observations; 2003, pp. 8; In English; Also announced as 20030014839; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Dynamic tensile strengths of two crustal rocks, San Marcos gabbro and Coconino sandstone (Meteor Crater, Arizona), were determined by carrying out flat plate impact experiments. Porosity of San Marcos gabbro is very low, and the reported porosity for Coconino sandstone is approx. 25%. Aluminum flyer plates were used for gabbro with impact velocities of 13 to 50 m/s, which produce tensile stresses in the range of 120 to 450 MPa. PMMA flyer plates were used for sandstone with impact velocities of 5 to 25 m/s, resulting tensile stresses in the range of approx. 13 to 55 MPa. Impact was normal to the bedding of sandstone. Tensile duration times for two cases were approx. 1 and approx. 2.3 microns, respectively. Pre-shot and post-shot ultrasonic P and S wave velocities were measured for the targets. Velocity reduction for gabbro occurred at approx. 150 MPa, very close to the earlier result determined by microscopic examination. The reduction of S wave is slightly higher than that of P wave. This indicates that the impact-induced cracks were either aligned, or there were residual fluids within cracks, or both. Data for sandstone velocity reduction was few and scattered caused by its high porosity. The range of dynamic tensile strength of Coconino sandstone is within 25 and 30 MPa. Obvious radial cracks at certain stresses indicate that deformation was not restricted to one dimensional strain as being assumed. Spall fragmentation occurred above 40 MPa. The combination of impact velocities,  $U$  (km/s), and impactor radii,  $a$  (m), are constrained by Meteor Crater fracture depth, approx. 850 m, and the dynamic tensile fracture strength from our experiments, 40 MPa. Volume of the crater for each impact was calculated using  $V = 0.009mU^{1.65}$ , where  $V$  is crater volume ( $\text{cu m}$ ),  $m$  is the mass of the impactor (kg). Volume of impact with  $U = 28$  km/s,  $a = 10$  m is close to the real Meteor

Crater volume,  $7.6e7$  cu m. Impact energy for this case is 3.08 Mt., which agrees well with theoretical calculation (3.3 to 7.4 Mt.). (1 Mt. =  $4.18e 15$ J).

Author

*Dynamic Models; Tensile Stress; Crystal Defects; Cracks; Impact Velocity; Rocks*

**20030014842** NASA Ames Research Center, Moffett Field, CA USA

**The Evolution of Oblique Impact Flow Fields Using Maxwell's Z Model**

Anderson, J. L. B., Brown Univ., USA; Schultz, P. H., Brown Univ., USA; Heineck, J. T., NASA Ames Research Center, USA; Impact Cratering: Bridging the Gap Between Modeling and Observations; 2003, pp. 9; In English; Also announced as 20030014839; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Oblique impacts are the norm rather than the exception for impact craters on planetary surfaces. This work focuses on the excavation of experimental oblique impact craters using the NASA Ames Vertical Gun Range (AVGR). Three-dimensional particle image velocimetry (3D PIV) is used to obtain quantitative data on ejection positions, three dimensional velocities and angles. These data are then used to constrain Maxwell's Z Model and follow the subsurface evolution of the excavation-stage flow-field center during oblique impacts.

Author

*Particle Image Velocimetry; Flow Distribution; Craters; Impact Prediction*

**20030014843** Academy of Sciences (USSR), Inst. for Dynamics of Geospheres, Moscow, USSR

**Oblique Impact and Its Ejecta: Numerical Modeling**

Artemieva, N., Academy of Sciences (USSR), USSR; Pierazzo, E., Planetary Science Inst., USA; Impact Cratering: Bridging the Gap Between Modeling and Observations; 2003, pp. 10-11; In English; Also announced as 20030014839; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

It is well known that impact events strike planetary surfaces at an angle from the surface. Assuming an isotropic flux of projectiles, probability theory indicates that the most likely angle of impact is 45 regardless of the body's gravitational field. While crater rims appear circular down to low impact angles, the distribution of ejecta around the crater is sensitive to the angle of impact and currently serves as the best guide to obliquity of impacts. A fair amount of numerical modeling of vertical impacts has been carried out from the early 60-s to the present time and references herein]. In vertical impacts, the axial symmetry of the process allows the simplification of the model to two dimensions (2D). Oblique impact modeling requires 3D hydro-codes and, hence, much more powerful computers. The first documented detailed oblique impact studies were carried out at Sandia National Labs' supercomputers less than 10 years ago to describe the 1994 collision of comet SL9 with Jupiter. Since then, substantial progress in computer science has made 3D modeling a reachable objective for the scientific community.

Author

*Numerical Analysis; Collisions; Comets; Craters; Ejecta*

**20030014844** California Univ., Earth Sciences Dept., Santa Cruz, CA USA

**Formation of Impact Craters on Comets and Asteroids: How Little is Known**

Asphaug, Erik, California Univ., USA; Impact Cratering: Bridging the Gap Between Modeling and Observations; 2003, pp. 12-13; In English; Also announced as 20030014839; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Impact phenomena shaped our solar system. From the accretion of planetesimals 4.6 billion years ago to the spallation of meteorites from their parent bodies, this process has left no bit of matter untouched. The study of impact craters on small bodies therefore provides a foundation for understanding accretion and the delivery of meteorites - topics central to the origin of planets. Moreover, geologic-scale impact craters forming in low gravity reveal details of the cratering process that are hidden on high-gravity worlds like the Earth and Moon. The detailed study of small body cratering began with efforts by Housen et al. (1979), Veverka and Thomas (1979) and others, together with efforts related to catastrophic disruption of small bodies. But the discovery of Stickney (the approx. 10 km diameter crater on the approx. 20 km diameter Martian satellite Phobos) and comparably huge divots imaged by Voyager on satellites of Jupiter and Saturn made it clear that small bodies can sustain huge wallops despite the conclusion of scaling models, notably that the impactor responsible for Stickney would have catastrophically disrupted Phobos.. While large impact structures on bodies with significant gravity are much better understood today than they were originally, for small bodies this is not the case. We appear almost to be back-pedaling towards an earlier vision of the asteroid impact process, pioneered by Art Clokey (without much guidance from geologists) in his 1957 Gumby claymation adventure "The Small Planets". Although nobody today confesses to expect clear gravity signatures around approx. 10 m craters on approx. 100 m asteroids (we have yet to obtain clear images of anything much smaller than ten kilometers), few expected copious regolith on bodies the size of Eros (33 x 13 km) either. Surprise is the norm. Fifteen years ago, bodies that size were widely believed to be capable of

sustaining a few centimeters of regolith at best. Instead, NEAR Shoemaker confirmed what had been hinted during less clearly resolved Galileo flybys of asteroids Gaspra and Ida: that Eros-sized asteroids can be awash in gravitationally bound debris (collisional or original is anybody's guess) ranging in size from approx. 100 m blocks to submicron grains accumulating in "ponds". Global regolith deposits on Eros range from 100's of m to undeterminable depth, and surface geophysics may even be dominated by quasi-aeolian processes such as electrostatic levitation and seismic shaking. Even on the smallest bodies yet observed, there is evidence for gravity dominance. Asteroid Ida's tiny (1.6 km) satellite Dactyl exhibits a spheroidal shape, as one would expect under self-gravitational control, and its major craters display rims and maybe central peaks. But to contrast Dactyl, Phobos, Deimos and other gravity regime Lilliputians, one finds 60 km Mathilde, a body which trashes every established theory of impact cratering, and which is from impact cratering's point of view one of the most astonishing bodies. Here one sees huge craters devoid of any gravity signature, and devoid of any signature of overprinting, on a pitted spheroid lacking visible fractures or other strength-related deformation. Nothing is here but the huge crater bowls themselves. Ejecta has either all entirely escaped or was never ejected at all, evidently in a target sufficiently porous to not communicate each blow globally, yet sufficiently cohesive for its crater rims not to collapse into softer shapes.

Derived from text

*Fractures (Materials); Formation; Impactors; Craters; Comets; Asteroids; Deformation*

**20030014845** Pittsburgh Univ., Dept. of Geology and Planetary Science, Pittsburgh, PA USA

**Small Impact Craters in Argentine Loess: A Step Up From Modeling Experiments**

Cassidy, W. A., Pittsburgh Univ., USA; Wright, S. P., Pittsburgh Univ., USA; Impact Cratering: Bridging the Gap Between Modeling and Observations; 2003, pp. 14; In English; Also announced as 20030014839; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The Campo del Cielo crater field in northern Argentina was formed about 4000 years ago by a shower of iron meteorites. The crater field contains at least twenty small impact craters, so there is a degree of redundancy here that is not often enjoyed in field work on impact craters. The target material is a very uniform, unconsolidated loess, and we could think of this as the same impact experiment repeated twenty times into the same target by projectiles of different mass, at nearly the same impact velocities, and over some range of impact angles. At least one, and possibly several of the larger craters are explosion-type features. The others were formed by shock-wave excavation and still contain the crater-causing masses within them. Most of the craters are small enough so that their original dimensions can be determined by trenching. The dimensions of each crater can be used to estimate the impact angle of the projectile and the energy of formation of the crater. When the mass of the crater-forming projectile has been determined, its velocity of impact can be calculated.

Author

*Craters; Impact Velocity; Energy of Formation; Targets*

**20030014846** Southwest Research Inst., Boulder, CO USA

**Cratering on Small Bodies: Lessons from Eros**

Chapman, C. R., Southwest Research Inst., USA; Impact Cratering: Bridging the Gap Between Modeling and Observations; 2003, pp. 15; In English; Also announced as 20030014839; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Cratering and regolith processes on small bodies happen continuously as interplanetary debris rains down on asteroids, comets, and planetary satellites. But they are very poorly observed and not well understood. On the one hand, we have laboratory experimentation at small scales and we have examination of large impact craters (e.g. Meteor Crater on Earth and imaging of abundant craters on terrestrial planets and outer planet moons). Understanding cratering on bodies of intermediate scales, tens of meters to hundreds of km in size, involves either extrapolation from our understanding of cratering phenomena at very different scales or reliance on very preliminary, incomplete examination of the observational data we now have for a few small bodies. I review the latter information here. It has been generally understood that the role of gravity is greatly diminished for smaller bodies, so a lot of cratering phenomena studied for larger bodies is less applicable. But it would be a mistake to imagine that laboratory experiments on gravitationless rocks (usually at 1 g) are directly applicable, except perhaps to those monolithic Near Earth Asteroids (NEAs) some tens of meters in size that spin very rapidly and can be assumed to be "large bare rocks" with "negative gravity". Whereas it had once been assumed that asteroids smaller than some tens of km diameter would retain little regolith, it is increasingly apparent that regolith and megoregolith processes extend down to bodies only hundreds of meters in size, perhaps smaller. Yet these processes are very different from those that pertain to the Moon, which is our chief prototype of regolith processes. The NEAR Shoemaker spacecraft's studies of Eros provide the best evidence to date about small-body cratering processes, as well as a warning that our theoretical understanding requires anchoring by direct observations. Eros: "Ponds", Paucity of Small Craters, and Other Mysteries. Although Eros is currently largely detached from interactions with main-belt

asteroids in its Earth-approaching orbit, almost all of its cratering history must have occurred in the main belt, where it almost certainly lived for a long time and where the impact rate is orders-of-magnitude greater than in its present environment. Thus NEAR Shoemaker's year-long orbital studies of Eros should be representative of asteroidal cratering processes for medium-small (tens of km) asteroids generally - with the caveat that small bodies are made of many different materials, ranging from metal to whatever comets are made of, and we already have indications from NEAR Shoemaker's flyby of Mathilde that responses to impacts on such bodies may be very different from what is observed on rocky Eros. As viewed from a distance, the saturated crater fields on Eros look similar to those on Ida and, indeed, on the Moon itself. It is at smaller scales, never before studied for asteroids, where Eros' appearance diverted dramatically from expectations based on modest extrapolations from our lunar experience. Flat, level "ponds" are common on Eros and were certainly not expected. Most striking, however, is the virtual absence of small-scale (cm to meters) craters and the dominance of rocks and boulders on the surface. Apparently many of the larger boulders were distributed about Eros by the comparatively recent impact that produced the Shoemaker crater, providing insight to ejecta processes on small bodies. But, assuming that Shoemaker didn't form practically "yesterday", the dearth of small craters is extremely puzzling. Some researchers have attempted to explain the shortage by traditional geological processes; I will explain why these fail and we are being forced to turn to explanations involving shortages of small projectiles in the asteroid belt (e.g. due to the Yarkovsky Effect). Even if projectile shortages help to explain the data, other non-lunar processes must be at work, as well. Mass-wasting processes are evident on large crater walls and the ponds reflect a still-not-understood deposition or sedimentation process. The boulder-strewn surface itself also serves to "armour" the surface against impacts. The role of seismic shaking on small bodies also must play a major role, relatively unfamiliar for larger bodies. I will summarize the observations of Eros that shed light on these various processes. Even Smaller Bodies. An interest in sub-km scale bodies has developed in the context of imagining how a potentially dangerous NEA might be diverted. Meanwhile, observational evidence concerning their general geophysical configurations has grown rapidly. A significant proportion of these bodies (approx. 20%) appear to have satellites or be binary in nature, and most of the remainder exhibit properties consistent with being "rubble piles" of one form or another. Eros, with less than a millionth the mass of the Moon, turned out to be extremely non-lunar-like in its small-scale responses to impact cratering. NEAs of the size being analyzed as prototypes for deflection are a millionth the mass of Eros. We should not expect our insights from Eros, therefore, to be directly applicable to them. and as we learn more about small asteroids and comets, we must expect to be surprised.

Author

*Asteroids; Comets; Debris; Gravitational Effects; Meteorite Craters; Regolith*

**20030014847** Arizona Univ., Lunar and Planetary Lab., Tucson, AZ USA

**Modeling Complex Crater Collapse**

Collins, G. S., Arizona Univ., USA; Turtle, E. P., Arizona Univ., USA; Impact Cratering: Bridging the Gap Between Modeling and Observations; 2003, pp. 16-17; In English; Also announced as 20030014839; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Impact crater collapse is the gravitationally driven modification of the cavity generated during the early stages of an impact event. It is the last major stage in the formation of an impact crater and has the most profound influence on the final morphology of the crater. The aim of this paper is to summarize the robust conclusions drawn from modeling crater collapse and highlight the questions that remain unanswered, particularly those that will require the collaboration of modelers and observers to answer.

Derived from text

*Models; Cratering; Computerized Simulation; Underground Explosions; Collapse*

**20030014848** Arizona Univ., Lunar and Planetary Lab., Tucson, AZ USA

**Numerical Simulations of Silverpit Crater Collapse: A Comparison of Tekton and SALES 2**

Collins, G. S., Arizona Univ., USA; Turtle, E. P., Arizona Univ., USA; Melosh, H. J., Arizona Univ., USA; Impact Cratering: Bridging the Gap Between Modeling and Observations; 2003, pp. 18; In English; Also announced as 20030014839; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

SALES 2 and Tekton are two numerical tools that have been used to simulate complex crater collapse. SALES 2 is a hydrocode capable of modeling the dynamic collapse of large impact craters. It has been successfully applied to the problem of central peak and peak-ring formation. Tekton is a finite-element code designed to be applied to a wide range of tectonic problems, where displacements are relatively small and the dynamics are less important. It has been used extensively to simulate the relaxation of large craters and the formation of exterior rings in multi-ring basins. Here we apply both techniques to the collapse of the Silverpit crater, to compare and contrast their capabilities.

Author

*Numerical Analysis; Collapse; Craters; Tectonics*

**20030014849** Sandia National Labs., Albuquerque, NM USA

**Application of Adaptive Mesh Refinement to the Simulation of Impacts in Complex Geometries and Heterogeneous Materials**

Crawford, D. A., Sandia National Labs., USA; Barnouin-Jha, O. S., Johns Hopkins Univ., USA; Impact Cratering: Bridging the Gap Between Modeling and Observations; 2003, pp. 19; In English; Also announced as 20030014839

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Adaptive mesh refinement (AMR) has been used for improving computational resolution on hyperbolic problems when resources are limited. For a mature Eulerian multi-material shock-physics code like CTH, adaptivity is considered a natural next step in code development. Recent work has demonstrated the utility of AMR for studying shock processes in 2-D heterogeneous targets for planetary impact applications. In this study, even more complex targets such as a pre-fractured 433 Eros are being simulated with 3-D AMR.

Author

*Computational Grids; Simulation; Impact*

**20030014856** California Univ., Space Sciences Lab., Berkeley, CA USA

**Magnetic Fields of Lunar Impact Basins and Their Use in Constraining the Impact Process**

Halekas, J. S., California Univ., USA; Lin, R. P., California Univ., USA; Impact Cratering: Bridging the Gap Between Modeling and Observations; 2003, pp. 28; In English; Also announced as 20030014839; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Measurements by the Magnetometer/Electron Reflectometer instrument on the Lunar Prospector spacecraft, which completed its mapping mission in 1999, have been used to construct the first completely global maps of lunar crustal magnetic fields. Now, for the first time, we have a data set with global coverage and a sensitivity and resolution which allow us to investigate the magnetic fields of lunar impact basins and craters. As on the Earth, impact sites have a variety of magnetic signatures associated with them, ranging from nearly complete demagnetization to strong central magnetic anomalies. Observations of the magnetic fields of terrestrial basins have been used to make inferences about the impact process, and we wish to show that lunar observations can also provide valuable constraints.

Derived from text

*Lunar Magnetic Fields; Lunar Rocks; Impact; Impact Velocity; Structural Basins*

**20030014858** Washington Univ., Dept. of Earth and Planetary Sciences, Saint Louis, MO USA

**Thicknesses of and Primary Ejecta Fractions in Basin Ejecta Deposits**

Haskin, Larry A., Washington Univ., USA; McKinnon, William B., Washington Univ., USA; Impact Cratering: Bridging the Gap Between Modeling and Observations; 2003, pp. 30; In English; Also announced as 20030014839

Contract(s)/Grant(s): NAG5-10458; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

We have developed a model for production of basin ejecta deposits to address provenances of materials collected at the Apollo and Luna landing sites and for consideration in interpreting remote sensing data.

Author

*Thickness; Ejecta; Fragments; Craters; Deposits*

**20030014859** Lunar and Planetary Inst., Houston, TX USA

**Constraints on the Impact Process from Observations of Oblique Impacts on the Terrestrial Planets**

Herrick, R. R., Lunar and Planetary Inst., USA; Hessen, K., Lunar and Planetary Inst., USA; Impact Cratering: Bridging the Gap Between Modeling and Observations; 2003, pp. 31; In English; Also announced as 20030014839; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Recently there have been significant advances in both experimental and numerical modeling techniques that hold promise for providing details on how the cratering process is affected by impact at a non-vertical angle. Anecdotal observations of craters on the terrestrial planets validated initial experimental efforts. Recent and ongoing systematic characterizations of craters resulting from oblique impact on the Moon, Mars, and Venus provide important constraints for the detailed modeling efforts currently being conducted.

Author

*Craters; Mathematical Models; Terrestrial Planets; Impact*

**20030014860** Calgary Univ., Dept. of Geology and Geophysics, Alberta Canada

**Linking Experimental Modelling of Impact Craters to Structural Components of the Real Thing**

Hildebrand, A. R., Calgary Univ., Canada; Impact Cratering: Bridging the Gap Between Modeling and Observations; 2003, pp. 32; In English; Also announced as 20030014839; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Impact crater scaling relationships, such as for impact energy, are usually derived solely from experimental impact or explosion craters. Relating craters to a suite of possible source projectiles, and predicting what size crater a given impactor will produce in a surface of known composition, are basic requirements for reconstructing impactor populations from cratering records, comparing cratering rates derived from cratering records to those derived from observed impactor populations (known velocities), and assessing the hazard associated with a given impactor.

Author

*Experimentation; Craters; Impact; Structural Design*

**20030014861** Washington Univ., Seattle, WA USA

**Does Melt Volume Give the Signature of the Impactor?**

Holsapple, K. A., Washington Univ., USA; Impact Cratering: Bridging the Gap Between Modeling and Observations; 2003, pp. 33; In English; Also announced as 20030014839; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Many analyses of impact events attempt to solve an inverse problem: Given the result, what was the impactor? One common example is the use of careful measurements of impact melt with the hope of deducing the impactor size and velocity.

Derived from text

*Impact Melts; Volume*

**20030014870** Budapest Science Univ., Dept. of Physical and Historical Geology, Hungary

**Crater Basin Rebound Above Plastic Layers: Model Based on Europa**

Kereszturi, Akos, Budapest Science Univ., Hungary; Impact Cratering: Bridging the Gap Between Modeling and Observations; 2003, pp. 44; In English; Also announced as 20030014839; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Isostatic rebound and mega-slumpings are important processes in the modification of large craters. Beside the examples for these on Mercury, Moon, Earth, Callisto (possibly Venus and Mars) we have good images from Europa. Analysis of internal rings and benches of great (usually greater than 100 km) craters and palimpsests help in the reconstruction of formation. The its young, pristine and tectonically homogene surfaced Europa can improve our knowledge in the reconstruction of crater basin formation.

Author

*Craters; Models; Structural Basins; Polymeric Films; Surface Layers*

**20030014884** Lunar and Planetary Inst., Houston, TX USA

**Importance of Target Properties on Planetary Impact Craters, Both Simple and Complex**

Schenk, P. M., Lunar and Planetary Inst., USA; Impact Cratering: Bridging the Gap Between Modeling and Observations; 2003, pp. 61; In English; Also announced as 20030014839; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

For 20 years, the issue of whether surface gravity or target properties control the shape of planetary craters has continued unabated. Periodic revisions to and questions about quality control of the planetary crater database have vexed the debate. Here I review the current status of the observations and our understanding of the results. The observational data fall into two related categories: crater depths, and morphologic transitions from one landform to another. As it turns out there is more than one way to measure these transitions. It would appear that both target gravity and properties are important.

Author

*Targets; Impact; Planetary Craters; Gravitation; Data Bases*

**20030014885** Wisconsin Univ., Albuquerque, NM USA

**Impact Crater Morphology as a Guide to Regolith Structure at Taurus-Littrow**

Schmitt, H. H., Wisconsin Univ., USA; Impact Cratering: Bridging the Gap Between Modeling and Observations; 2003, pp. 62; In English; Also announced as 20030014839; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Mapping of variables in primary crater morphology relative to crater size can be used as an initial guide to factors that will affect mining and processing of that material for lunar resources such as helium-3, hydrogen, oxygen and water. Although time did not permit the systematic mapping of craters during the Apollo 17 exploration of the Valley of Taurus Littrow, the writer was

able to provide descriptions of the variety of crater morphologies present. About 3.5 b.y. ago, the Valley of Taurus-Littrow and its surroundings had been blanketed with a dark, pyroclastic mantle. Orange and black varieties of this mantle were specifically sampled at Station 4, Shorty Crater as well as being a significant component of most samples of the regolith. All of the craters investigated, observed, and described are younger than the period of pyroclastic mantling. Every later impact, however, re-mobilized the fine pyroclastic material as well as the developing regolith, partially mantling all nearby younger materials.

Author

*Impact Damage; Craters; Morphology; Regolith; Lunar Resources*

**20030016680** Lawrence Livermore National Lab., Livermore, CA USA

**Using Vulcan to Recreate Planetary Cores**

Collins, G. W.; Celliers, P. M.; Hicks, D. G.; Mackinnon, A. J.; Moon, S. J.; Aug. 15, 2001; In English; This document is color dependent and/or in landscape layout. It is currently only available on CD-ROM

Report No.(s): DE2002-801560; UCRL-ID-145157; No Copyright; Avail: National Technical Information Service (NTIS)

An accurate equation of state (EOS) for planetary constituents at extreme conditions is the key to any credible model of planets or low mass stars. However, experimental validation has been carried out on at high pressure (less than few Mbar), and then only on the principal Hugoniot. For planetary and stellar interiors, compression occurs from gravitational force so that material states follow a line of isentropic compression (ignoring phase separation) to ultra-high densities'. An example of the predicted states for water along the isentrope for Neptune is shown. The cutaway figure on the left is from Hubbard2, and the phase diagram on the right is from Hugoniot magnetic field data. Thus any data, which provide rigid constraints for these models will have a significant impact on a broad community of planetary and condensed matter scientists. Recent laser shock wave experiments have made great strides in recreating material states that exist in the outer 25% (in radius) of the Jovian planets and at the exterior of low-mass stars. Large laser facilities have been used to compressed materials to ultra-high pressures and characterize their thermodynamic and transport properties (plastic Hugoniot to 40 Mbar, deuterium Hugoniot to 3 Mbar, metallization of 'atomic' deuterium on the Hugoniot). To probe materials properties at these high pressures, several experimental techniques were developed high resolution radiography, optical reflectance, pyrometry, and velocity/displacement sensitive interferometry are some of the diagnostics currently used in laser-generated shock EOS experiments.

NTIS

*Earth Mantle; Earth Planetary Structure; Earth Core; Condensed Matter Physics; Magnetic Fields*

**20030018094** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

**Geologic Mapping of the Chaac-Camaxtli Region of Io from Galileo Imaging Data**

Williams, David A., Arizona State Univ., USA; Radebaugh, Jani, Arizona Univ., USA; Keszthelyi, Laszlo P., Arizona Univ., USA; McEwen, Alfred S., Arizona Univ., USA; Lopes, Rosaly M. C., Jet Propulsion Lab., California Inst. of Tech., USA; Doute, Sylvain, Jet Propulsion Lab., California Inst. of Tech., USA; Greeley, Ronald, Arizona State Univ., USA; Journal of Geophysical Research; 2002; ISSN 0148-0227; Volume 107, No. E9, pp. 6-1 - 6-15; In English

Contract(s)/Grant(s): NAG5-8897

Report No.(s): Paper-2001JE001821; Copyright; Avail: Issuing Activity

We produced a geologic/geomorphologic map of the Chaac-Camaxtli region of Io's leading anti-Jovian hemisphere using regional resolution (186 m/pixel) Galileo imaging data collected during orbit I27 (February 2000) integrated with lower resolution (1.4 km/pixel) color data, along with other Galileo imaging and spectral data. This is the first regional map of Io made from Galileo data. Nine color and geomorphologic units have been mapped, and the close proximity of dark and various colored bright materials suggests that there is an intimate interaction between (presumably) silicate magmas and sulfur-bearing volatile materials that produced a variety of explosive and effusive deposits in the recent geologic past. This region of Io is dominated by 11 volcanic centers, most of which are paterae that are analogous in morphology to terrestrial calderas but larger in size. Mapping of structural features indicates that most of the active regions occur in topographic lows, and less active or inactive paterae are associated with topographic highs. This indicates that crustal thickness variations influence magma access to the surface. Surface changes in this region since the Voyager flybys (1979) are relatively minor (additional bright and dark flows, color changes), although several active vents have migrated within paterae. This observation, along with the identification of the relatively regular spacing of paterae (approx. 100- 150 km) along a line, may indicate there are multiple interlacing fractures in the crust that serve as magma conduits from the interior. This connection between volcanism and tectonism may have implications for tidal heating mechanisms and their effect on Io's lithosphere. Some inactive patera floors may be evolving into bright plains material, which, if composed of silicates, might explain the strength of Io's crust to support steep patera walls and tall mountains.

Author

*Mapping; Geological Surveys; Geomorphology; Imaging Techniques; Io*

**20030018095** NASA Ames Research Center, Moffett Field, CA USA

**The Pascal Mars Scout Mission**

Haberle, R. M., NASA Ames Research Center, USA; [2002]; 7p; In English; Mars Atmosphere Modeling and Observation Workshop, 11-16 Jan. 2003, Granada, Spain

Contract(s)/Grant(s): RTOP 344-33-20-16; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Except for Earth, Mars is the planet most amenable to surface-based climate studies. Its surface is accessible, and the kind of observations that are needed, such as meteorological measurements from a long-lived global network, are readily achievable. Weather controls the movement of dust, the exchange of water between the surface and atmosphere, and the cycling of CO<sub>2</sub> between the poles. We know there is a weather signal, we know how to measure it, and we know how to interpret it. Pascal seeks to understand the long-term global behavior of near-surface weather systems on Mars, how they interact with its surface, and, therefore, how they control its climate system. To achieve this, Pascal delivers 18 Science Stations to the surface of the planet that operate for three Mars years (5.6 Earth years). The network has stations operating in the tropics, midlatitudes, and polar regions of both hemispheres. During entry, descent, and landing, each Pascal probe acquires deceleration measurements to determine thermal structure, and descent images to characterize local terrain. On the surface, each Science Station takes daily measurements of pressure, opacity, temperature, wind speed, and water vapor concentration and monthly panoramic images of the landing environment. These data will characterize the planet's climate system and how atmosphere-surface interactions control it. The Pascal mission is named after 17th century French Scientist, Blaise Pascal, who pioneered measurements of atmospheric pressure. Pressure is the most critical measurement because it records the "heartbeat" of the planet's general circulation and climate system. Derived from text

*Mars Missions; Atmospheric Pressure; Planetary Surfaces; Spacecraft Instruments; Climatology*

**20030018108** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

**Evaluation of Sulfur Flow Emplacement on Io from Galileo Data and Numerical Modeling**

Williams, David A., Arizona State Univ., USA; Greeley, Ronald, Arizona State Univ., USA; Lopes, Rosaly M. C., Jet Propulsion Lab., California Inst. of Tech., USA; Davies, Ashley G., Jet Propulsion Lab., California Inst. of Tech., USA; Journal of Geophysical Research; Dec. 25, 2001; ISSN 0148-0227; Volume 106, No. E12, pp. 33,161-33,174; In English

Contract(s)/Grant(s): NAG5-8897

Report No.(s): Paper-2000JE001340; Copyright; Avail: Issuing Activity

Galileo images of bright lava flows surrounding Emakong Patera have been analyzed and numerical modeling has been performed to assess whether these flows could have resulted from the emplacement of sulfur lavas on Io. Images from the solid-state imaging (SSI) camera show that these bright, white to yellow Emakong flows are up to 370 km long and contain dark, sinuous features that are interpreted to be lava conduits, approx. 300-500 m wide and is greater than 100 km long. Near-Infrared Mapping Spectrometer (NIMS) thermal emission data yield a color temperature estimate of 344 K +/- 60 K (less than or equal to 131 C) within the Emakong caldera. We suggest that these bright flows likely resulted from either sulfur lavas or silicate lavas that have undergone extensive cooling, pyroclastic mantling, and/or alteration with bright sulfurous materials. The Emakong bright flows have estimated volumes of approx. 250-350 cu km, similar to some of the smaller Columbia River Basalt flows. If the Emakong flows did result from effusive sulfur eruptions, then they are orders of magnitude greater in volume than any terrestrial sulfur flows. Our numerical modeling results show that sulfur lavas on Io could have been emplaced as turbulent flows, which were capable of traveling tens to hundreds of kilometers, consistent with the predictions of Sagan [ 1979 and Fink et al. [ 1983]. Our modeled flow distances are also consistent with the measured lengths of the Emakong channels and bright flows. Modeled thermal erosion rates are approx. 1-4 m/d for flows erupted at approx. 140-180 C, which are consistent with the melting rates of Kieffer et al. [2000]. The Emakong channels could be thermal erosional in nature; however, the morphologic signatures of thermal erosion channels cannot be discerned from available images. There are planned Galileo flybys of Io in 2001 which provide excellent opportunities to obtain high-resolution morphologic and color data of Emakong Patera. Such observations could, along with further modeling, provide additional information to better constrain whether sulfur lavas produced the Emakong flows.

Author

*Sulfur; Io; Galileo Spacecraft; Lava; Turbulent Flow; Erosion; Fluid Flow*

**20030018448** Arizona State Univ., Dept. of Geological Sciences, Tempe, AZ USA

**Geology and Origin of Europa's Mitten Feature (Murias Chaos)**

Figueredo, P. H., Arizona State Univ., USA; Chuang, F. C., Arizona State Univ., USA; Rathbun, J., Redlands Univ., USA; Kirk, R. L., Geological Survey, USA; Greeley, R., Arizona State Univ., USA; Journal of Geophysical Research; [2002]; ISSN 0148-0227; Volume 107, No. E5, pp. 2-1 - 2-15; In English

Contract(s)/Grant(s): NAG5-8897

Report No.(s): Paper-2001JE001591; Copyright; Avail: Issuing Activity

The "Mitten" (provisionally named Murias Chaos by the International Astronomical Union) is a region of elevated chaos-like terrain in the leading hemisphere of Europa. Its origin had been explained under the currently debated theories of melting through a thin lithosphere or convection within a thick one. Galileo observations reveal several characteristics that suggest that the Mitten is distinct from typical chaos terrain and point to a different formational process. Photoclinometric elevation estimates suggest that the Mitten is slightly elevated with respect to the surrounding terrain; geologic relations indicate that it must have raised significantly from the plains in its past, resembling disrupted domes on Europa's trailing hemisphere. Moreover, the Mitten material appears to have extruded onto the plains and flowed for tens of kilometers. The area subsequently subsided as a result of isostatic adjustment, viscous relaxation, and/or plains loading. Using plate flexure models, we estimated the elastic lithosphere in the area to be several kilometers thick. We propose that the Mitten originated by the ascent and extrusion of a large thermal diapir. Thermal-mechanical modeling shows that a Mitten-sized plume would remain sufficiently warm and buoyant to pierce through the crust and flow unconfined on the surface. Such a diapir probably had an initial radius between 5 and 8 km and an initial depth of 20-40 km, consistent with a thick-lithosphere model. In this scenario the Mitten appears to represent the surface expression of the rare ascent of a large diapir, in contrast to lenticulae and chaos terrain, which may form by isolated and clustered small diapirs, respectively.

Author

*Terrain; Chaos; Europa; Lithosphere; Geology; Crusts*

**20030018449** Arizona State Univ., Dept. of Geological Sciences, Tempe, AZ USA

**En Echelon Ridge and Trough Structures on Europa**

Michalski, Joseph R., Arizona State Univ., USA; Greeley, Ronald, Arizona State Univ., USA; Geophysical Research Letters; [2002]; ISSN 0094-8276; Volume 29, No. 10, pp. 136-1 - 136-4; In English

Contract(s)/Grant(s): NAG5-8897

Report No.(s): Paper-2002GL014956; Copyright; Avail: Issuing Activity

Europa's surface is tectonically and morphologically complex. European ridges, bands, ridged bands, double ridges, complex ridges, and troughs are collectively referred to as lineaments. Some lineaments are fault zones and exhibit sets of en echelon ridge and trough structures (EERTS). EERTS can be used to interpret the stress field in which the lineaments formed. These observations suggest that some lineaments at low latitudes initially formed as shear zones, rather than as purely tensional fractures as is commonly assumed. From stepping directions of EERTS and the offset directions of the lineaments in which they occur, we infer that some EERTS form as a result of compressional stress and others form as a result of tensional stress. EERTS that are inferred to form in compression are morphologically indistinguishable from EERTS that form in tension. The presence of tensional EERTS may support a diapiric origin for some ridges.

Author

*Europa; Structural Properties (Geology); Troughs; Fractures (Materials); Stress Distribution*

92

**SOLAR PHYSICS**

*Includes solar activity, solar flares, solar radiation and sunspots. For related information see 93 Space Radiation.*

**20030015750** Colorado Univ., Lab. for Atmospheric and Space Physics, Boulder, CO USA

**Solar/Stellar Irradiance Comparison Experiment (SOLSTICE) on the Upper Atmosphere Research Satellite (UARS) Final Report, 1997 - 2001**

Rottman, Gary J., Colorado Univ., USA; Woods, Thomas N., Colorado Univ., USA; London, Julius, Colorado Univ., USA; Ayres, Thomas R., Colorado Univ., USA; Jan. 15, 2003; 6p; In English

Contract(s)/Grant(s): NAG5-11028; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

A final report on the operational activities related to the UARS Solar Stellar irradiance Comparison Experiment (SOLSTICE) is presented. Scientific activities of SOLSTICE has also been supported. The UARS SOLSTICE originated at the University of Colorado in 1981. One year after the UARS launch in 1991, the operations and research support activities for SOLSTICE were moved to the High Altitude Observatory (HAO) of the National Center for Atmospheric Research (NCAR). The SOLSTICE program continued at HAO with the National Science Foundation, and after four years, it was moved once again back to the University of Colorado. At the University after 1997 this subject grant was issued to further extend the operations activities from

July 2001 through September 2002. Although this is a final report for one particular activity, in fact the SOLSTICE operations activity -first at the University, then at HAO, and now again at the University -has continued in a seamless fashion.

Derived from text

*Solar Radiation; Upper Atmosphere Research Satellite (UARS); Spacecraft Instruments; Solstices; Spacecraft Launching*

**20030017843** Smithsonian Astrophysical Observatory, Cambridge, MA USA

**Unified Models of Turbulence and Nonlinear Wave Evolution in the Extended Solar Corona and Solar Wind Annual Report, 1 May 2002 - 30 Apr. 2003**

Cranmer, Steven R., Smithsonian Astrophysical Observatory, USA; [2003]; 4p; In English

Contract(s)/Grant(s): NAG5-11913

Report No.(s): Rept-1; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The PI (Cranmer) and Co-I (A. van Ballegoijen) made significant progress toward the goal of building a "unified model" of the dominant physical processes responsible for the acceleration of the solar wind. The approach outlined in the original proposal comprised two complementary pieces: (1) to further investigate individual physical processes under realistic coronal and solar wind conditions, and (2) to extract the dominant physical effects from simulations and apply them to a one-dimensional and time-independent model of plasma heating and acceleration. The accomplishments in the report period are thus divided into these two categories: 1a. Focused Study of Kinetic MHD Turbulence. We have developed a model of magnetohydrodynamic (MHD) turbulence in the extended solar corona that contains the effects of collisionless dissipation and anisotropic particle heating. A turbulent cascade is one possible way of generating small-scale fluctuations (easy to dissipate/heat) from a pre-existing population of low-frequency Alfvén waves (difficult to dissipate/heat). We modeled the cascade as a combination of advection and diffusion in wavenumber space. The dominant spectral transfer occurs in the direction perpendicular to the background magnetic field. As expected from earlier models, this leads to a highly anisotropic fluctuation spectrum with a rapidly decaying tail in the parallel wavenumber direction. The wave power that decays to high enough frequencies to become ion cyclotron resonant depends on the relative strengths of advection and diffusion in the cascade. For the most realistic values of these parameters, though, there is insufficient power to heat protons and heavy ions. The dominant oblique waves undergo Landau damping, which implies strong parallel electron heating. We thus investigated the nonlinear evolution of the electron velocity distributions (VDFs) into parallel beams and discrete phase-space holes (similar to those seen in the terrestrial magnetosphere) which are an alternate means of heating protons via stochastic interactions similar to particle-particle collisions. 1b. Focused Study of the Multi-Mode Detailed Balance Formalism. The PI began to explore the feasibility of using the "weak turbulence," or detailed-balance theory of Tsytovich, Melrose, and others to encompass the relevant physics of the solar wind. This study did not go far, however, because if the "strong" MHD turbulence discussed above is a dominant player in the wind's acceleration region, this formalism is inherently not applicable to the corona. We will continue to study the various published approaches to the weak turbulence formalism, especially with an eye on ways to parameterize nonlinear wave reflection rates. 2. Building the Unified Model Code Architecture. We have begun developing the computational model of a time-steady open flux tube in the extended corona. The model will be "unified" in the sense that it will include (simultaneously for the first time) as many of the various proposed physical processes as possible, all on equal footing. To retain this generality, we have formulated the problem in two interconnected parts: a completely kinetic model for the particles, using the Monte Carlo approach, and a finite-difference approach for the self-consistent fluctuation spectra. The two codes are run sequentially and iteratively until complete consistency is achieved. The current version of the Monte Carlo code incorporates gravity, the zero-current electric field, magnetic mirroring, and collisions. The fluctuation code incorporates WKJ3 wave action conservation and the cascade/dissipation processes discussed above. The codes are being run for various test problems with known solutions. Planned additions to the codes include prescriptions for nonlinear wave steepening, kinetic velocity-space diffusion, and multi-mode coupling (including reflection and refraction).

Derived from text

*Magnetohydrodynamic Turbulence; Velocity Distribution; Electric Fields; Solar Corona; Solar Wind; Nonlinearity*

## 93

### SPACE RADIATION

*Includes cosmic radiation; and inner and outer Earth radiation belts. For biological effects of radiation on plants and animals see 52 Aerospace Medicine. For theory see 73 Nuclear Physics.*

**20030014806** NASA Langley Research Center, Hampton, VA USA

**Space Radiation Transport Methods Development**

Wilson, J. W., NASA Langley Research Center, USA; Tripathi, R. K., NASA Langley Research Center, USA; Qualls, G. D.,

NASA Langley Research Center, USA; Cucinotta, F. A., NASA Johnson Space Center, USA; Prael, R. E., Los Alamos National Lab., USA; Norbury, J. W., Wisconsin Univ., USA; Heinbockel, J. H., Old Dominion Univ., USA; Tweed, J., Old Dominion Univ., USA; [2002]; 10p; In English; World Space Congress 2002, 10-19 Oct. 2002, Houston, TX, USA; Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche; Distribution as joint owner in the copyright; Distribution as joint owner in the copyright

Improved spacecraft shield design requires early entry of radiation constraints into the design process to maximize performance and minimize costs. As a result, we have been investigating high-speed computational procedures to allow shield analysis from the preliminary design concepts to the final design. In particular, we will discuss the progress towards a full three-dimensional and computationally efficient deterministic code for which the current HZETRN evaluates the lowest order asymptotic term. HZETRN is the first deterministic solution to the Boltzmann equation allowing field mapping within the International Space Station (ISS) in tens of minutes using standard Finite Element Method (FEM) geometry common to engineering design practice enabling development of integrated multidisciplinary design optimization methods. A single ray trace in ISS FEM geometry requires 14 milliseconds and severely limits application of Monte Carlo methods to such engineering models. A potential means of improving the Monte Carlo efficiency in coupling to spacecraft geometry is given in terms of reconfigurable computing and could be utilized in the final design as verification of the deterministic method optimized design.

Author

*Extraterrestrial Radiation; Manned Space Flight; Space Exploration; Asymptotic Methods; Mathematical Models; Spacecraft Design*

**20030018452** Smithsonian Astrophysical Observatory, Cambridge, MA USA

**Package for Interactive Analysis of Line Emission (Analysis of UV-X-Ray High-Resolution Emission Spectra) Annual Report, 1 Feb. 2002 - 31 Jan. 2003**

Kashyap, Vinay, Smithsonian Astrophysical Observatory, USA; February 2003; 2p; In English

Contract(s)/Grant(s): NAG5-9322; No Copyright; Avail: Issuing Activity; Abstract Only

PINTofALE is an IDL based package to analyze high-resolution grating spectra. The first version was made available to the public on 3 February 2001. Since then we have carried out numerous changes, and the current release is version 1.5, released on 9 October 2002. The changes include upgrades to handle higher versions of IDL, the new version of the CHIANTI database (v4), major enhancements in user-friendliness, improved handling of response matrices, the ability to handle 24-bit color, access to the Atomic Plasma Emission Database (APED), and beta releases of Markov Chain Monte Carlo (MCMC) based DEM fitting routines. Plans for the future include: inclusion of MCMC techniques in the fitting programs, enhanced graphics capabilities, an overhaul of the line and continuum database structure, and bug fixes. In September 2002, we hired a data analyst (LiWei Lin) to work on PINTofALE. Mr. Lin is concentrating on incorporating MCMC as well as simpler Monte-Carlo techniques, fast RMF convolution, etc., into the code base, as well as reviewing the existing documentation and searching for bugs. A detailed description of the package, together with fairly detailed documentation, example walks-throughs, and downloadable tar files, are available on-line from <http://hea-www.harvard.edu/PINTofALE/>

Author

*Emission Spectra; On-Line Systems; Plasma Radiation; Graphic Arts*

## 99

### GENERAL

*Includes aeronautical, astronautical, and space science related histories, biographies, and pertinent reports too broad for categorization; histories or broad overviews of NASA programs such as Apollo, Gemini, and Mercury spacecraft, Earth Resources Technology Satellite (ERTS), and Skylab; NASA appropriations hearings.*

**20030015765** Air Force Academy, Library, CO USA

**Air Power and Warfare: A Supplement**

White, Elwood L.; Feb. 2002; 94p; In English

Report No.(s): AD-A409343; SPECIAL BIB SER-99; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

This highly selective bibliography supplements the original bibliography developed in 1978 by Ms. Betsy C. Kysely, to support the Eighth Military History Symposium. While this bibliography focuses primarily on materials published since the earlier bibliography was developed, it does include some significant materials that were published prior to 1978, but that were omitted from that edition. Emphasis in this supplement is on scholarly analysis of air power itself and scholarly depictions of its history. Like most editions of the United State Air Force Academy Directorate of Libraries' publication, Special Bibliography Series, this compilation is limited to current holdings of the Academic Library at the Academy. It includes books, reports, government

documents, and journal articles. Excluded are pictorial works, newspaper articles, works of fiction, studies of the technology of aircraft and associated weaponry, and items focused on the general history of aviation. Readers wanting information on the history of aviation, certainly prior to the Wright Brothers, are encouraged to consult the U S. Air Force Academy Friends of the Library publication, *The Genesis of Flight: The Aeronautical History Collection of Colonel Richard Gimbel*.

DTIC

*Bibliographies; General Aviation Aircraft*

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