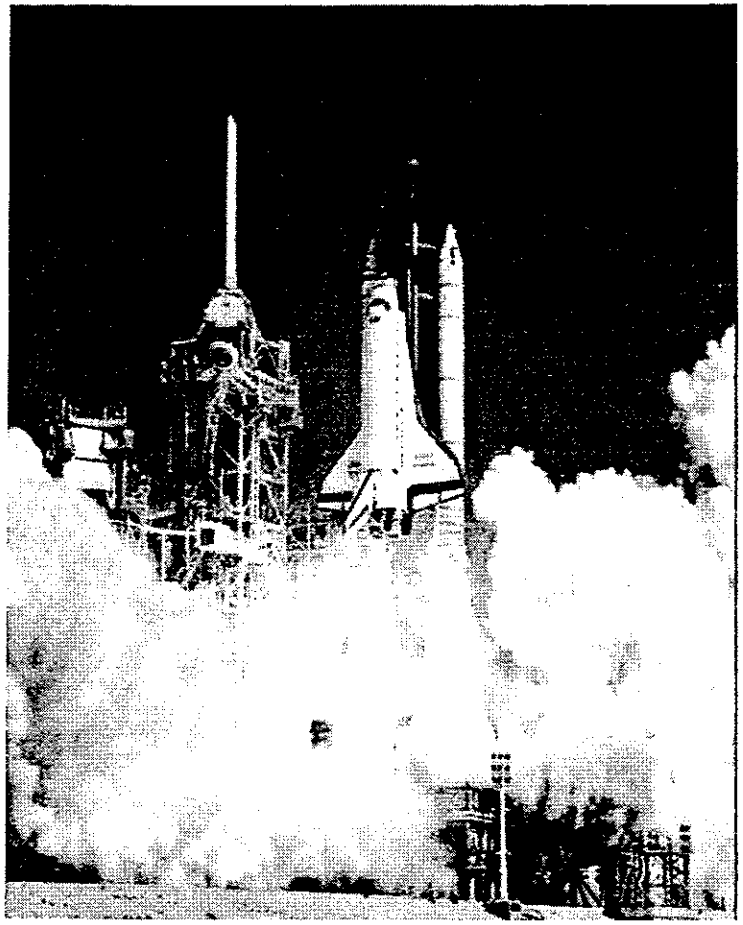
Special Considerations - Contingency Planning

- Special Space Shuttle contingency boards.
  - On call rapid response team trained in agency investigation policies with supporting sub teams with expertise in specific Shuttle systems and operations.
  - Standing Interagency board of senior personnel independent of NASA for Administrator level boards.



NASA Space Shuttle Contingency Plans

September 18, 2002

David Whittle

Space Shuttle Program Overview

Goals:

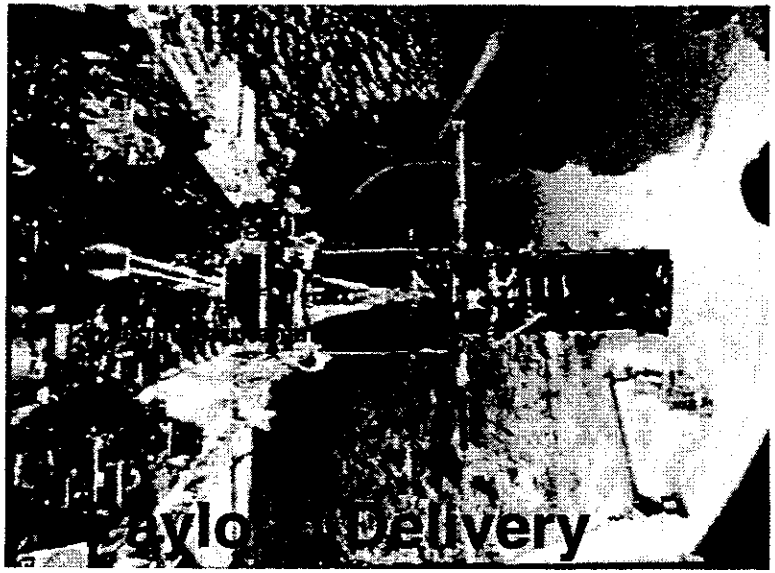
Fly Safely

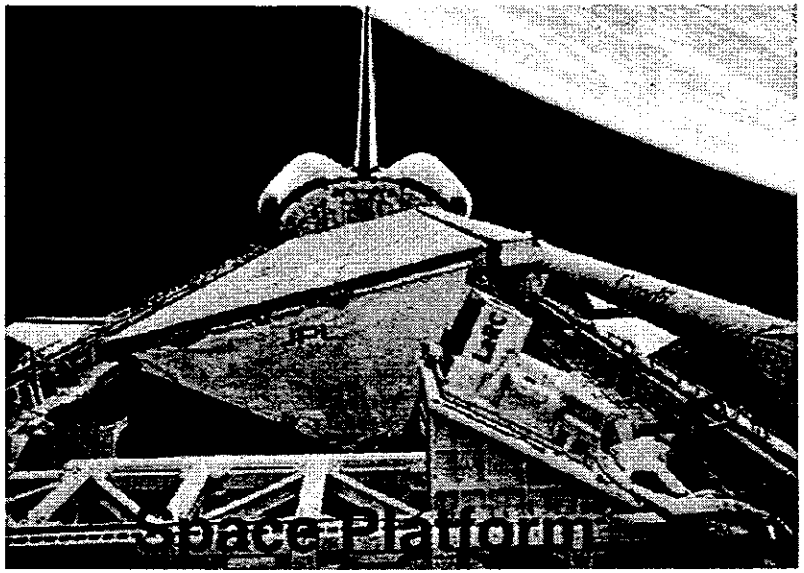
Meet The Manifest

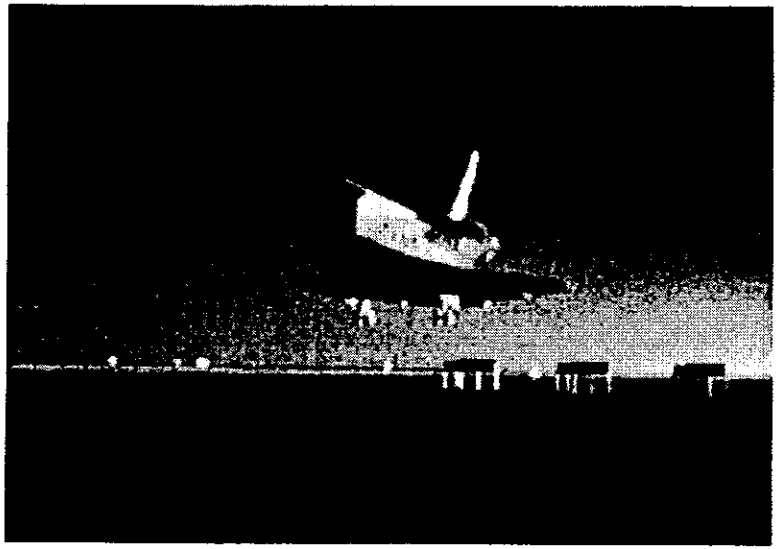
Improve Mission Supportability

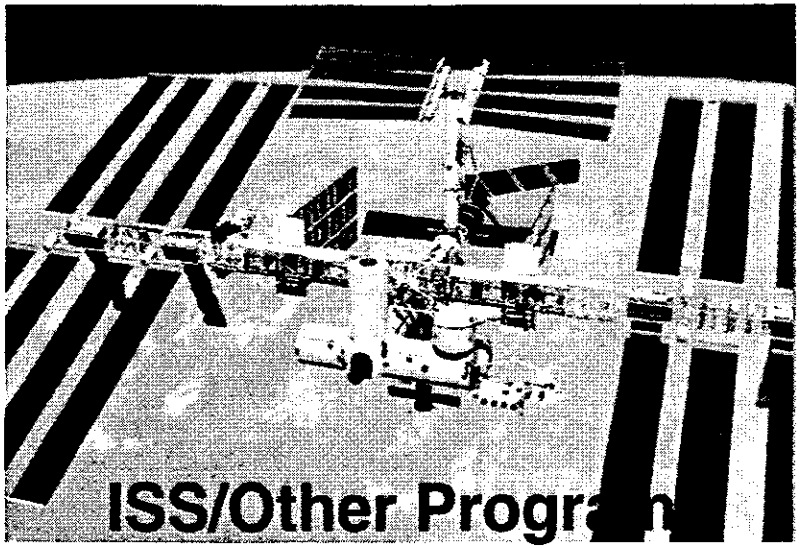
Improve The System

Space Shuttle Program Overview - Capabilities



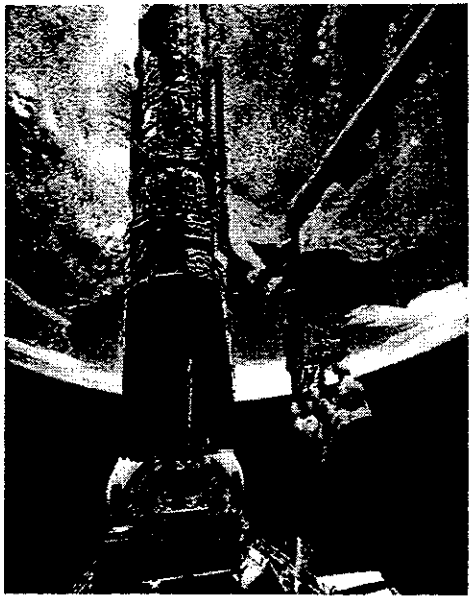




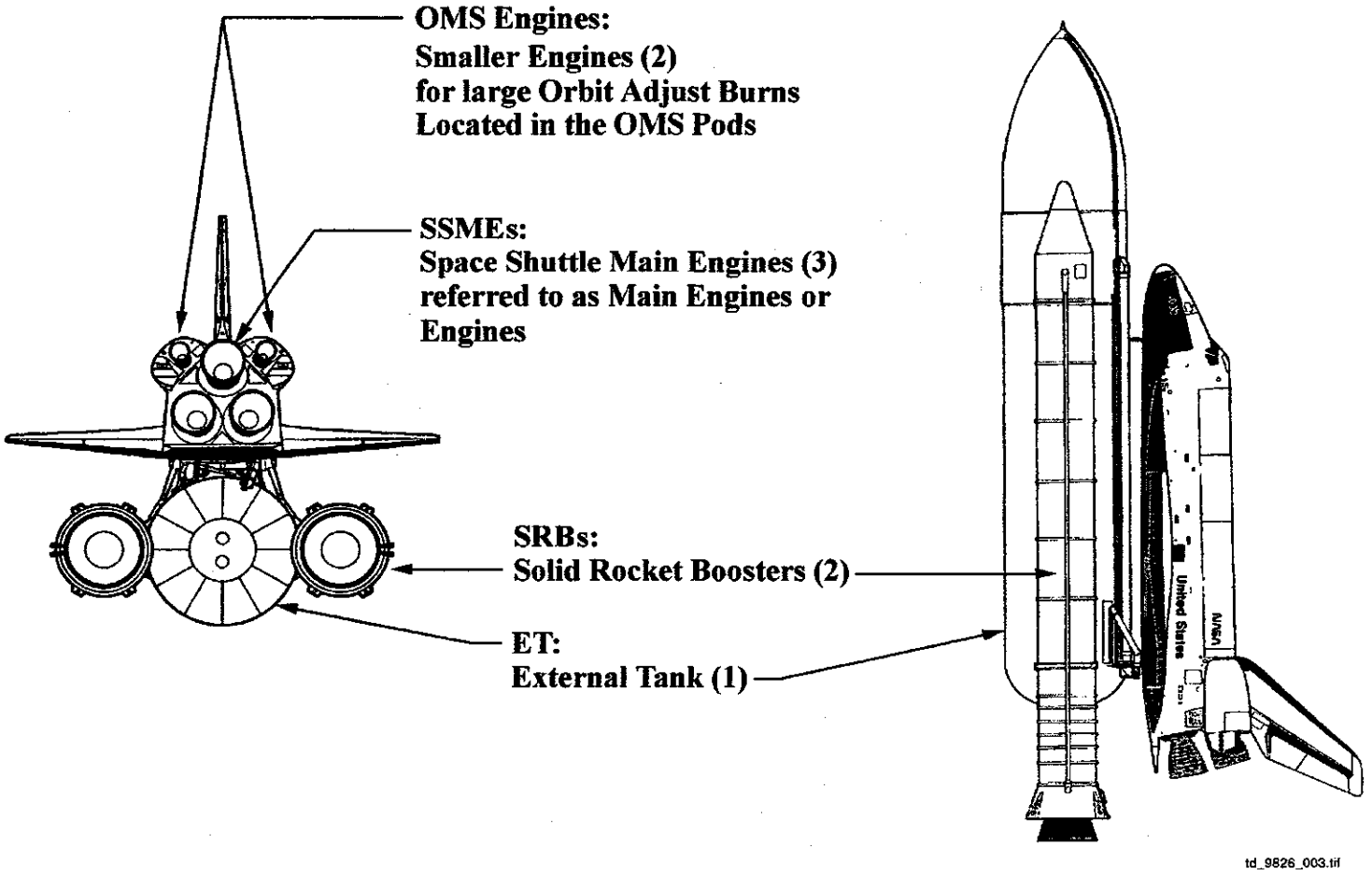


Shuttle Activity Since Challenger

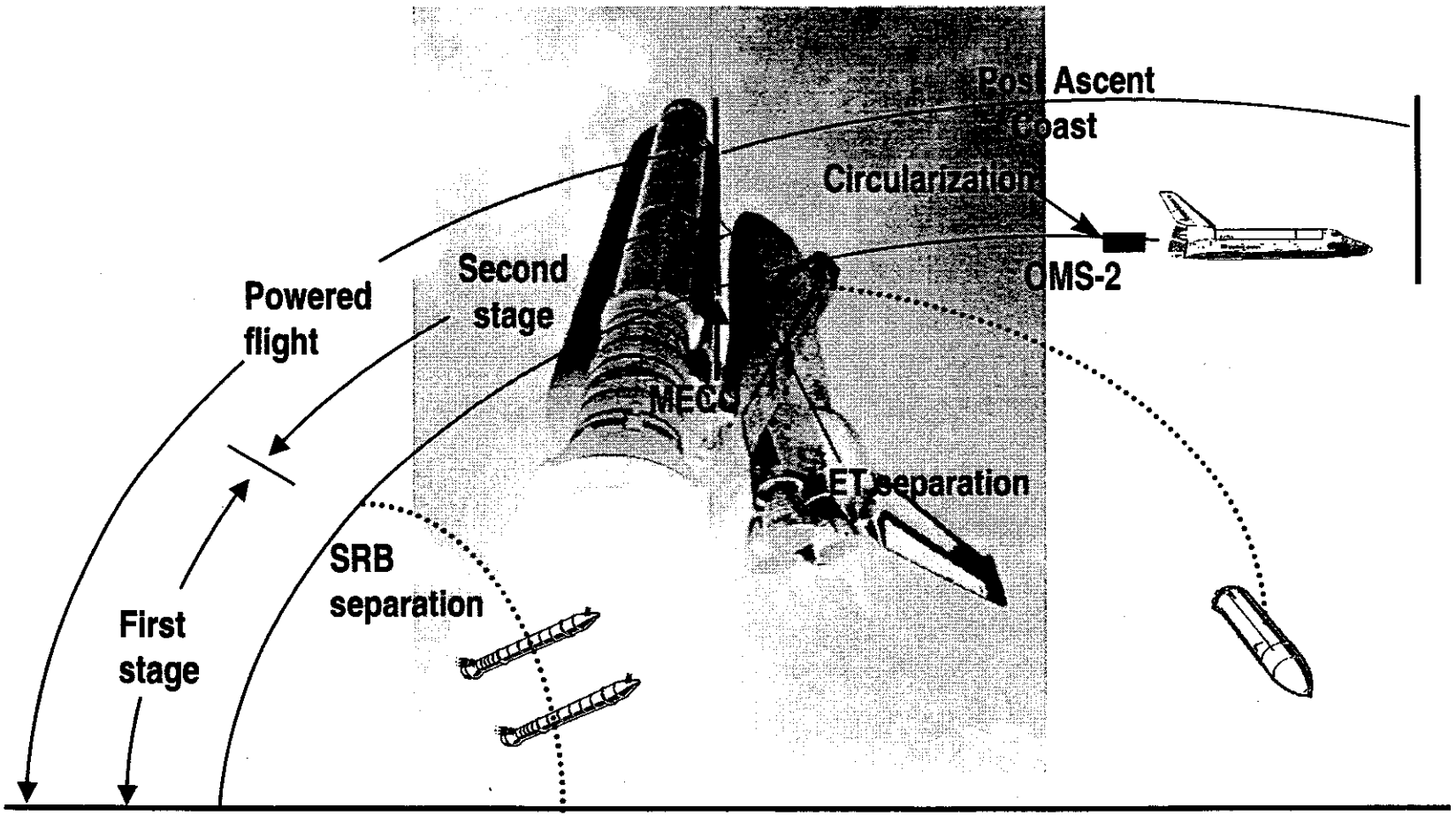
- 40 scientific platforms (stay attached to shuttle)
- 1 commercial deployable (25 before Challenger)
- 3 planetary deployables
- 25 scientific/technology deployable platforms (some retrievable and also shown in retrievable payloads category)
- 8 major ISS element deployables
- 17 spacecraft retrieved/returned
- 5 spacecraft repaired and/or serviced
- 7 ISS utilization/logistics cargos
- 8 DoD missions



Shuttle Components



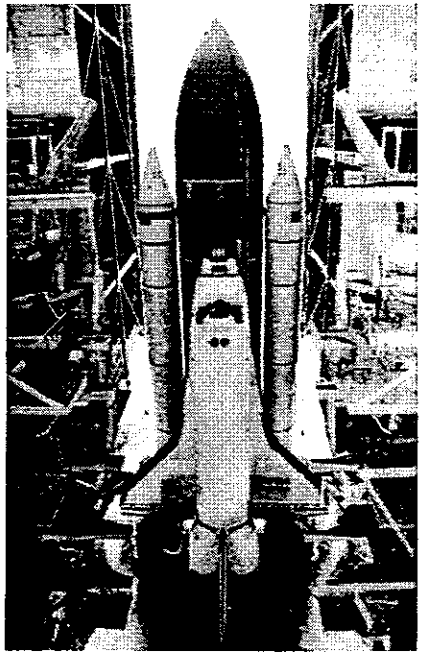
Ascent Definitions



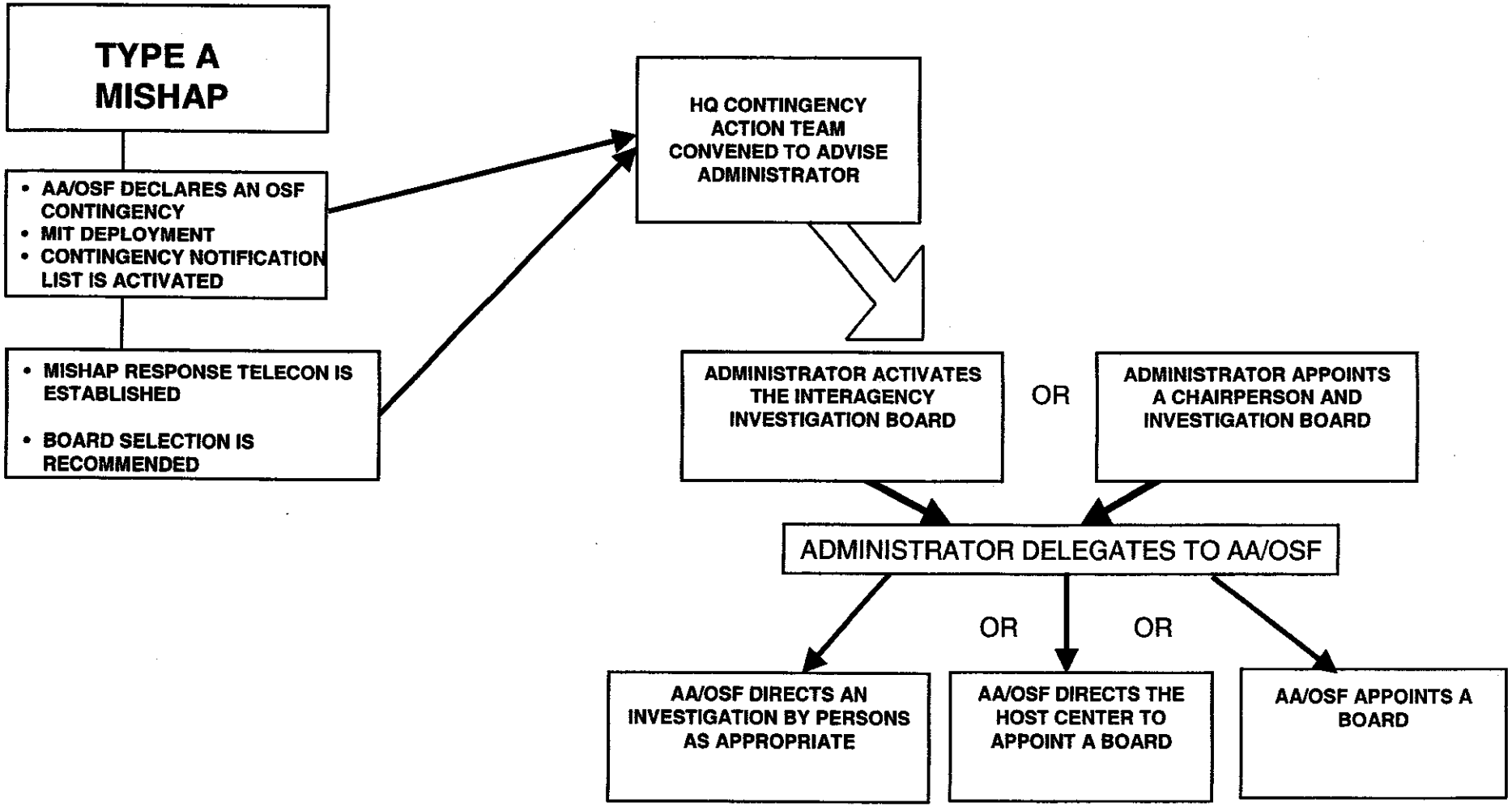
Spaceflight Operations Contingency Preparedness

- NASA has in place the plans, training, and the independent review processes to address contingency and catastrophic situations.
- These situations may present themselves in a variety of ways some of which represent loss of mission, others loss of vehicle and crew:

  - Major malfunction on launch pad
  - Transoceanic abort (TAL)
  - Contingency abort
  - Return to launch site (RTLS)
  - Major vehicle malfunction during ascent
  - Major vehicle malfunction on orbit
  - Major vehicle malfunction during entry
  - Crash landing at landing site
  - Incident while mounted on Shuttle Carrier Aircraft (SCA)
  - Major incident in the Orbiter Processing facility (OPF)
  - Major incident in the vehicle assembly building (VAB)



Activation of Agency Contingency Action Plan for Spaceflight Operations



Mishap Investigation Team (MIT) aka "go team"

- A trained, rapid response team that the Space Shuttle Program may deploy to any Shuttle incident site in a contingency situation.
- The team consists of the following personnel:
  - -- Chairman
  - -- Flight-trained crew representative
  - -- Flight Surgeon
  - -- Orbiter engineer
  - -- Main propulsion system engineer
  - -- Photographer
  - -- DDMS * representative
  - -- Payload representative
  - -- Safety representative
  - -- Administrative manager
  - -- Ground Operations manager

  *(DDMS: Department of Defense Manager's Space Shuttle Support)

  (Note: All of the above must have attended either the Shuttle Crash Investigation or an Aircraft Mishap Investigation Course.)

- The MIT travels to the incident site on a rapid response aircraft and they are the initial Accident Investigation Board. Their primary responsibilities are to:
  - -- Secure the site and control access.
  - -- Document the original state of the evidence.
  - -- Locate witnesses and obtain initial statements, names, and addresses.

MIT Supporting Teams

SPACE SHUTTLE
MISHAP INVESTIGATION TEAM
RAPID RESPONSE TEAM
CREW RECOVERY TEAM

WORKING GROUPS

KENNEDY SPACE CENTER

- RECORDS AND WITNESSES
- FIRE, EXPLOSIVES, TOXICOLOGICAL AND RADIOLOGICAL
- LAUNCH, LANDING, AND RETRIEVAL OPERATIONS
- FACILITIES AND GROUND SUPPORT
- PAYLOADS
- FLIGHT OPERATIONS AND NETWORKS
- FLIGHT CREW
- PROCEDURES REVIEW
- NATIONAL RESOURCES PROTECTION
- INTERCENTER TIMELINE
- INTERCENTER PHOTO/TV
- CLASSIFIED DATA
- SEARCH, RECOVERY AND RECONSTITUTION
- PUBLIC AFFAIRS

JOHNSON SPACE CENTER

- IMPOUNDMENT/CLASSIFIED DATA
- SYSTEMS INTEGRATION
- ORBITER AND GFE PROJECTS
- PROPULSION AND POWER
- NAVIGATION, CONTROL & AERONAUTICS
- STRUCTURES AND MECHANICS
- CREW AND THERMAL SYSTEMS
- MISSION OPERATIONS
- FLIGHT CREW OPERATIONS
- PAYLOADS/CARGO
- PHOTO AND TV ANALYSIS
- RECORDS AND WITNESS
- TIMELINE
- PUBLIC AFFAIRS
- FIRE EXPLOSIVES AND RADIOLOGICAL
- MEDICAL AND TOXICOLOGICAL
- MEDICAL CONTINGENCY

DRYDEN FLIGHT RESEARCH CENTER

- INSTITUTIONAL/ADMINISTRATIVE
- NETWORKS
- GROUND OPERATIONS
- AIR FORCE FLIGHT TEST CENTER

MARSHALL SPACE FLIGHT CENTER

- EXTERNAL TANK
- SOLID ROCKET BOOSTER
- REDESIGNED SOLID ROCKET MOTOR
- SPACE SHUTTLE MAIN ENGINE
- SPACE SHUTTLE SYSTEMS
- TRANSPORTATION

GODDARD SPACE FLIGHT CENTER

- MANAGEMENT OPERATIONS
- PAYLOADS
- NETWORKS

Preparedness

The following actions have been taken to ensure that the Office of Space Flight (OSF) maintains its readiness to handle any OSF-related program mishaps:

- **Contingency simulation exercises have been performed in the past and are scheduled approximately every 18 months to provide training to space Shuttle program managers in addressing specific contingency situations.**
- **Top-level OSF program contingency policy documents are revised regularly to maintain currency.**
- **Field centers are required to provide an updated list of single points of contact and to maintain a listing of working group chairpersons.**
- **Members of the mishap investigation team, the rapid response team, and the crew recovery team, are in place prior to each mission.**
- **Office of Space Flight program contingency notification lists are updated periodically and distributed to HQ OSF managers, as required.**
- **Office of Space Flight program contingency-related information is updated as required and is reviewed, at a minimum, prior to each mission.**

Standing Mishap Interagency Investigation Board

The board consists of seven members, supported by the Office of Space Flight (OSF) Headquarters, OSF Field Centers, and technical consultants as required. Board Membership is as follows:

1. **USAF Chief of Safety, Maj. Gen. Ken W. Hess (Kirtland AFB, NM)**
2. **FAA Director of Accident Investigation, Mr. Steven B. Wallace (Washington, DC)**
3. **Commander, 14th Air Force, Maj. Gen. Michael A. Hamel (Vandenberg AFB, CA)**
4. **Commander, Naval Safety Center, Rear Adm. Stephen Turcotte (Norfolk, VA)**
5. **DOT Chief of Aviation Safety Division, Dr. James N. Hallock (Cambridge, MA)**
6. **Commander, Air Force Flight Test Center, Maj. Gen. Wilbert D. Pearson (Edwards AFB, CA)**
7. **NASA Field Center Director or NASA Program Associate Administrator (non-OSF or non-mission-related)**

Ex-officio member: NASA Associate Administrator, Office of Safety and Mission Assurance, Mr. Bryan O'Connor (NASA Headquarters, Washington, DC)

Executive Secretary: NASA Chief Engineer, Mr. Theron M. Bradley Jr. (NASA Headquarters, Washington, DC)

Note: The NASA Administrator will select the Board chair from the names in 1-6 above. The Board may obtain technical support from government or non-government sources on an as needed basis.

Board Operating Guidelines

- The investigation board duties of each board member will take precedence over all other duties
- The conduct of this investigation will be done using the established NASA support structure of working groups, NASA field centers contingency support plans, and supporting facilities as provided in the office of space flight contingency action plan. This includes staff advisors as required for expertise in areas such as public affairs, legal, medical, safety, and security.

Any questions on the Shuttle MIT and Interagency Mishap Investigation Board?

Summary

- NASA philosophy:
  - Identify root cause and contributing factors to prevent mishap recurrence using structured and proven investigation methodology.
  - Non-punitive system.
- NASA needs quick and thorough investigation to ensure safety of process and return to flight to support Agency mission objectives.
- Policy and guideline:
  - Ensures an unbiased, independent, and thorough investigation of the facts.
  - Provides closed-loop tracking system to implement recommendations.
  - Provides maximum "cross fertilization" through lessons learned.

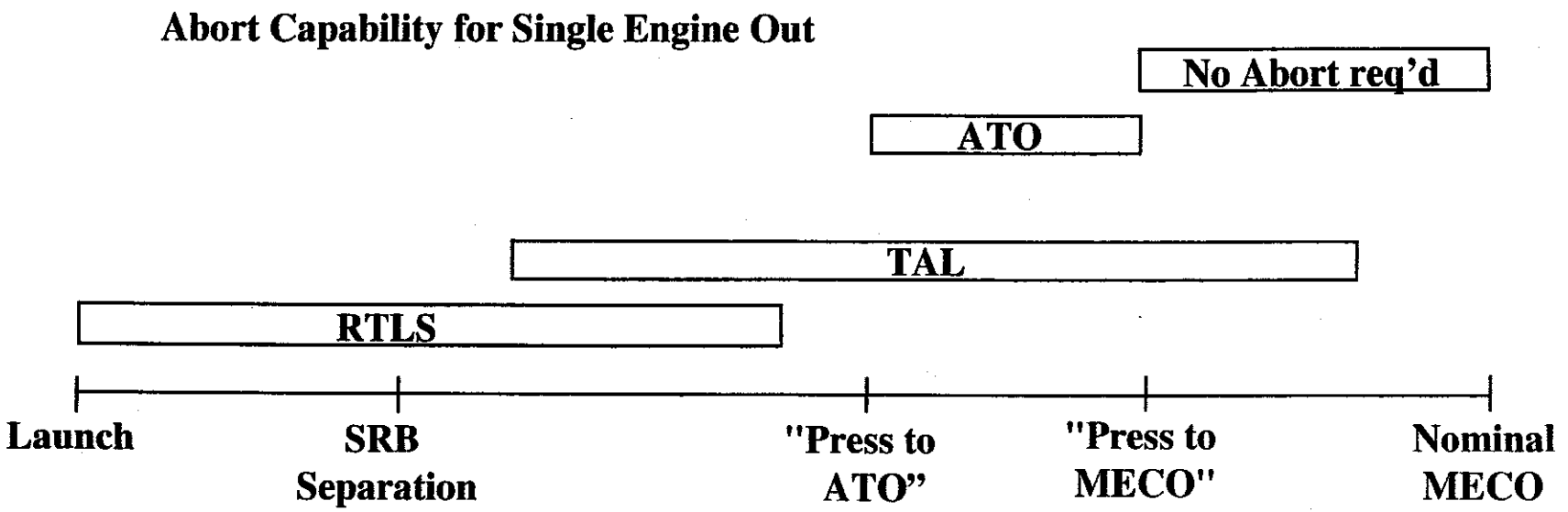
Summary (continued and completed)

- Capability and competencies:
  - Trained and experienced professionals.
  - Capability to perform all analysis required to complete the investigation.
  - Separate independent, interagency board for Administrator-level needs
  - Status/level of members ensures credibility.

Back-Up Slides

Timeline for Ascent Aborts

Our trajectory is designed such that we always have the capability (performance) to successfully complete at least one of the aborts. This is true even if one of the SSMEs has failed



Witness Statements

Basic NASA mishap investigation policy/philosophy regarding witnesses and their statements:

- **Witness statements given in the course of a NASA mishap investigation are privileged and non-releasable.**
- **NASA may also withhold other information in a NASA mishap investigation report from release, depending on such factors as to whether such information is classified, privileged, or involves privacy considerations.**
- **NASA recognizes that the ultimate decision on release of statements or information in a NASA mishap investigation report may reside in a court or administrative body outside NASA.**

Investigation Training

- NASA personnel have training and experience in accident investigation.
- NASA offers the following training to potential NASA investigators:
  - Management Oversight and Risk Tree (5 days)
    - Covers MORT, barrier analysis, cause effect analysis, witness interviewing and more
  - Shuttle aircraft investigation (5 days)
  - MORT refresher (3 days)
  - Human Factors in mishap Investigation (3 days)
  - Mishap investigation (computer-based training)

Key Definitions

- **NASA Mishap-** Any unplanned occurrence or event resulting from any NASA operation or NASA equipment anomaly, involving .... loss of property or equipment, or mission failure provided that a written agreement or contract between NASA and another party did not otherwise allocate operational control and corrective action responsibility.

- **Type A Mishap** - A mishap causing death and/or damage to equipment or property equal to or greater than $1 million. Mishaps resulting in damage to aircraft, space hardware, or ground support equipment that meet these criteria are included, as are test failures in which the damage was unexpected or unanticipated.

- **NASA Mishap Investigation Board-** A NASA-sponsored board, consisting of a single individual or a group of individuals with expertise in the area under investigation which is appointed to investigate a NASA Mishap. Board members must not have any vested interest in the outcome of the investigation. Board members may be selected from NASA, or other Government agencies. Observers may be obtained from these same sources or from non-Government sources, such as consultants.

Key Definitions

- **Mission Failure.** A mishap of whatever intrinsic severity that, in the judgment of the Enterprise Associate Administrator and the Associate Administrator for Safety and Mission Assurance, prevents the achievement of primary NASA mission objectives as described in the mission operations report or equivalent document.
- **Appointing Official.** The official authorized to appoint the mishap investigation board, mishap investigator, medical board, Center-level investigation, or technical investigation team to investigate a mishap or close call, or to accept the investigation of another authority. This official is also authorized to accept the final mishap investigation report, direct the responsible organization to develop a Corrective Action Plan (CAP), accept the CAP, track and close corrective actions, and produce a summary report of mishap-related activities upon completion.
- **Approving Official.** The official with the final responsibility to review and accept the NASA mishap investigation report as complete and in conformance with NASA policy.

Key Definitions

- **Significant Observation.** A factor, event, or circumstance identified during the investigation that did not contribute to the mishap or close call, but if left uncorrected has the potential to cause a mishap, injury, or increase the severity should a mishap occur.
- **Finding.** A conclusion based on facts established during the investigation by the investigating authority.
- **Recommendation.** An action developed by the investigation board to correct the cause or a deficiency identified during the investigation. The recommendations may be used in the preparation of the corrective action plan.
- **Corrective Actions.** Changes to design processes, work instructions, workmanship practices, training, inspections, tests, procedures, specifications, drawings, tools, equipment, facilities, resources, or material that result in preventing, minimizing, or limiting the potential for recurrence of a mishap.

Key Definitions

- **Root Cause Analysis.** The root cause analysis is a structured process for identifying the basic factors, reasons, and causes for conditions that result in mishaps or close calls. Once identified, the conditions can be corrected and future mishaps or close calls prevented.
- **Dominant Root Cause.** Along a chain of events leading to a mishap or close call, the first causal action or failure to act that could have been controlled systemically either by policy/practice/procedure or individual adherence to policy/practice/procedure.
- **Contributing Root Cause.** A factor, event, or circumstance which led, directly or indirectly, to the dominant root cause, or which contributed to the severity of the mishap or close call.

Mishap Investigation Training Courses

Back Up Information

NASA Mishap Investigation Training

- Management Oversight and Risk Tree Based Mishap Investigation and Refresher
- Human Factors in Mishap Investigation
- Space Shuttle Crash Investigation
- Aircraft Mishap Investigation
- Mishap Investigation Board Chairperson

NSTC 006, MORT-based Mishap Investigation

Course length - 5 Days

The purpose of this workshop is to provide the student the knowledge and the analytical tools and techniques to conduct effective and efficient investigations and to report the results of those investigations clearly and concisely. While the basics of mishap investigation and evidence collection are discussed, the focus of the course is on the application of analytical techniques based on the Management Oversight and Risk Tree (MORT) approach to accident investigation. Lecture and theory are reinforced by practical examples and exercises. The information presented is sufficient for investigation of major type A and B mishaps by members of boards of investigation, but is also easily adapted for use by individuals investigating lesser mishaps

NSTC 014, Management Oversight and Risk Tree (MORT)- Based Mishap Investigation Refresher

Course length - 2 Days

The MORT-based Mishap Investigation. Refresher course is provided to update the student's knowledge of NASA mishap investigation policies, procedures, and requirements. The practical aspects of investigation and reporting - initial response, collecting and interpreting evidence, managing an investigation, writing the report – will be briefly reviewed, and proficiency in the application of commonly used analytical tools, including MORT, will be sharpened through classroom training and student group exercises. Students participating in this course should have previously taken a MORT-based Mishap Investigation course.

NSTC 012, Human Factors in Mishap Investigation

Course length - 3 Days

This course is specifically focused on the analysis of human error and human factor contributions to mishaps. It will discuss the human factors aspects of mishap causation and also advocate the use of the Management Oversight and Risk Tree (MORT) and/or the Incident Analysis Tool (Modified) for an in-depth analysis of mishaps to identify human factors contribution. The course provides an overview of basic human factors and MORT concepts. The human error analysis aspects of MORT will be expanded using concepts from other analytical techniques and a modified MORT diagram will be presented and used during class on scenarios based on actual NASA mishaps.

NSTC 018, Space Shuttle Crash Investigation

Course length - 4 Days

This course provides instruction in aviation accident investigation basics and policy, with a focus on investigation of mishaps concerning the Space Shuttle. Topics discussed include: fast response requirements, investigator qualifications, board organization and field techniques. Evidence identification, recovery and protection, medical issues, photography, witness interviewing and site mapping are key areas discussed during sessions on field investigation. Course content also addresses OSHA 1910.1030, bloodborne pathogen requirements and NASA requirements on addressing the news media. The course is focused on Space Shuttle crashes and references SSP MIB documents and guidelines, but also contains extensive accident investigation information generally applicable to aviation accidents.

NSTC 019, Aircraft Mishap Investigation

Course length - 3 Days

This course provides field investigation and management techniques for the individual who must respond to the crash scene and assure the capture of as much evidence as possible in a minimum amount of time. Topics of discussion include pre-mishap preparation, witness interviewing, systems investigation, medical issues, response to the scene, photography, preserving evidence, site mapping, and structural failure mode determinations. Discussion of supporting analytical services and laboratory methods is included for familiarization, but not covered in depth. The course instructor uses practical examples and discussion of actual aircraft mishaps in teaching the do's and don'ts of field investigation.

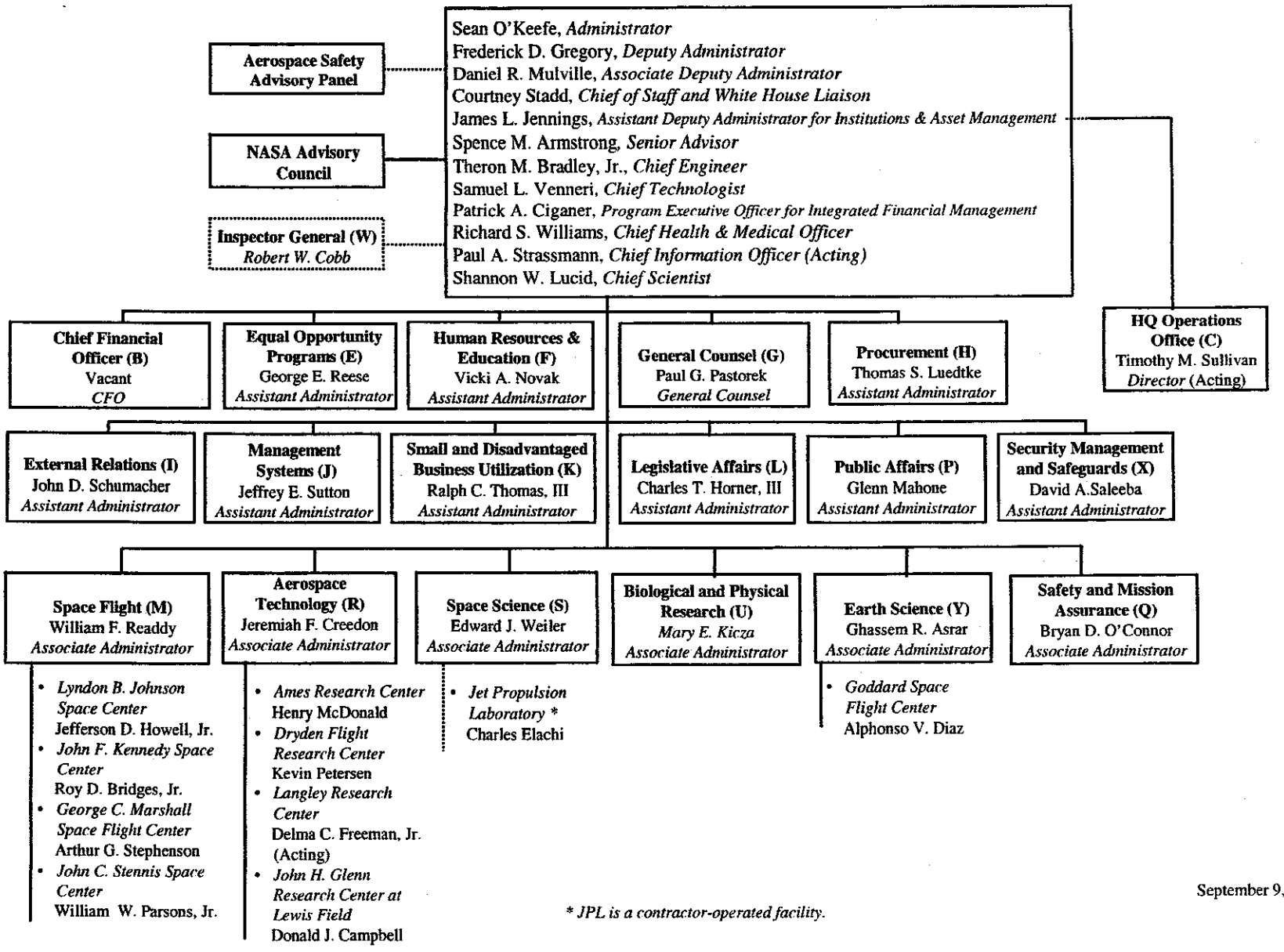
NSTC 024, Mishap Investigation Board Chairperson

Course length - 1 Day

The Mishap Investigation Board Chairperson course is provided to update the student's knowledge of NASA mishap investigation policies, procedures, and requirements as they relate to leading/managing a board. The practical aspects of investigation and reporting - initial response, collecting and interpreting evidence, managing an investigation, writing the report – will be reviewed, and the application of commonly used analytical tools, including MORT, will discussed. Principles and practices of use to any type of mishap investigation will be included.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

Office of the Administrator



* JPL is a contractor-operated facility.

September 9, 2002

To: MARY E KICZA <mkicza@mail.hq.nasa.gov>
From: Faith Chandler <fchandle@hq.nasa.gov>
Subject: Fwd: STS-107 Hazardous Material List
Cc:
Bcc:
Attached: C:\Documents and Settings\fchandle\My Documents\attach\STS-107 Hazardous Material 2-02-03.doc;

Mary,

Here is the information that you requested.
Gil provided Victor with this information.

SMA is gathering the FMEA's and Fault Trees for the Payloads.
I will be in the SMA action room today.
You may reach me by the cell phone number if you require any assistance.

X-Sender: gwhite1@mail.hq.nasa.gov
X-Mailer: QUALCOMM Windows Eudora Version 4.3.2
Date: Sun, 02 Feb 2003 18:30:16 -0500
To: prutledg@hq.nasa.gov, Faith Chandler <fchandle@hq.nasa.gov>
From: Gilbert White-1 <gwhite1@hq.nasa.gov>
Subject: STS-107 Hazardous Material List

FYI

Faith maybe you know how to get in touch with Victor?

Gilbert White

Manager, International Space Station Operations
Office of Safety and Mission Assurance
(202) 358-0562

Mission Success Starts With Safety

(+/-)-2-Methyl-2,4-pentanediol
(1H,3H)-pyrimidinedione
(2 -keto- 3 -deoxy-6-phosphogluconate)
0-Nitrophenyl-beta-D-Galactopyranoside and
1 Potissium nitrate
1,2-Dichloroethane C2H4C12
1,4 dithio-DL -threitol
10799 D-Glucose (Well 24)
10806 Fluconazole (Well 26) 4 ug/ml 0.08 ug
2 -Mercaptoethanol
2,3,5 Triphenyltetrazolium chloride(Well 12)
2-Mercaptoethanol
3 g/tissue)Mild tomoderateeye 1 0 1 None 1 0 ILastmodifiec
3enzalkonium wipes:
4G-63 Human osteosarcoma cells
5-Bromo-4-chloro-3 -indolylphosphate
5-Nitro-6-(1 '-D)-Ribitylamino-2,4
Adonitol (Well 16)
Agarose
Agarose Type VI1
Agrobacterium suspension in MS medium
Alpha-MEM
Ammonium nitrate
Ammonium sulphate
Amphotericin
Ampicillin
Arabinose
Arginine monohydrochloride
Ascorbic acid
Ascorbic acid-2-phosphate
Aspartyl-t RNA synthetase isolated from
Bacitracin
bacterium Thermus thermophilus
Batteries, lithium manganese dioxide
Benzalkonium chloride
beta-Glycerophosphate
Biotin
Boric acid
C3HlOTl/2-derived cell line (xs Brachyury)
Cadmium sulfate crystalline
Calcium chloride
Calcium chloride crvstal
Calcium pantothenate
Calcium Phosphate, dibasic
Canamycin (antibiotic)
Cancidas (Well 1 2)
Carbencillin
Casamino acids
Casein hydrolysate
Catalyst: titanium dioxide granules, 1 mm dia.
Cefotaxime
Cellobiose
Chloramphenicol
Chloromethyl isothhiazolin
Chorobenzene (D,)
Chromium potassium sulfate

Chromobacterium violaceum ATCC 12472
Ciprofloxacin HC1
Citrate
Citric acid monohydrate
Cobalt chloride
Cultisphere microcarriers
Cupric carbonate
Cupric sulfate
Cycloheximide and
Cycloheximide and D-Glucose (Well 22)
Cytosine arabinoside (ara-C)
Dexamethasone
Dextrose
D-Glucose (Well 24)
Dihydroxyacetone - phosphate (DHAP)
Dimethoxyethane Proprietary <1 .O ml
Di-potassium hydrogen phosphate
Dodecyl dimethyamine oxide
Dodecylmal toside
Dulcitol (WELL 15)
Erythritol (Well 20)
Esculin and
Ethylhydrocupreine hydrochloride (Well 3)
Fenichrome
Ferric Ammonium Citrate (Well 8)
Ferric citrate
Ferritin Type I from horse
Ferrous sulfate
Fetal Bovine Serum
Fetal calf serum
Fluconazole (Well 2 1)
Fluconwole (Well 23)
Fluorescent bulbs 8659 Mercury 100%
Fluorobenzene (D,)
Folic acid
Freon 11 5
Freon 22
Freon 502: azeotropic mixture of
Fungizone (amphotericin-B)
Galactose (Well 2)
Gentamycid Amphotericin-B, 1000 UI
Gentamycin
Gentamycin sulphate
Glucose
Glutaraldehyde
Glycerol
Guanidine thiocyanate
Guanidinium isothiocyanate
Halon 1301
HECAMEG (detergent)
Hemicellulase
Hep tanetriol
HEPES, pH 7.5
Hexitol bisphosphate
Human liver fructose -1,6-bisphosphatase
Human parathyriod hormone 1-84

Hy gromycin
Hydrocortisone
Inhibitor HNAP (C1106PH7Na2)
Insulin from bovine pancreas
Inulin
Isopropanol
Isopropyl-beta-D-ThioGalactopyranoside (23)
Kanamycin
Lactate (and)
Lactose
L-ascorbic acid-2-phosphate
L-Aspartic acid
Latmnculin A (1 UM) in aqueous DMSO
L-Glutamic acid, monosodium salt
Lithium
Lithium aluminum tetrachloride
Lithium perchlorate
L-kginine
Lysine (Well 28)
Magnesium carbonate
Magnesium oxide
Magnesium sulfate
Malonate (Well 9)
Maltose
Manganese
Manganese chloride
Mannitol
Melezitose
Melibiose
Menadione Sodium Bisulfate Complex
Mercury
Methyl isothiazolin
Methyl-D-Glucoside
Molybdic acid, sodium salt
Na acetate pH 4.6
Na Cacodylate
N-acetyl-D-glucosamine
N-dodecyl-dimethyl-phosphine oxide
Niacin
NiCox: Flurbiprofen-nitroxylbutyl-ester
Novobiocin (Well 13)
Octylglucoside
ollagen coating (half slide surface)
Ornithine (Well 30)
Oryzalin (1 0 uM) in aqueous ethanol
Oxone
Palatinose
Paraformaldehyde
p-Coumaric (Well 21)
Penicillin G (Well 19) w/GPS A medium
Poly ethylene glycol 400
Poly ethylene glycol 425
Polyethylene glycol 1000
Polyethylene glycol 4000
Polyethylene glycol 6000
Polymyxin B (Well 1 1)

Polyvinyl chloride
Potassium aluminum sulfate 25.7% wlv
Potassium benzoate
Potassium chromium sulfate 2.5% wlv
Potassium citrate, monohydrate
Potassium hvdroxide
Potassium Iodate
Potassium iodide
Potassium nitrate
Potassium phosphate
Potassium sodium tartrate, KNaC4H406
Potassium sulfate
Prostaglandin E2
Proteose peptone
Pullulan (Well 24)
Pyridoxine HC1
Pyrodinium bahamense
Pyruvic Acid (Well 23)
Raffinose
Raloxifine hydrochloride
retradecane
Rhamnose (Well 24)
Ribose
Salicin (Well 18)
Ske~tom~cin
Sodium acetate pH 4.8
Sodium bicarbonate
Sodium Chloride
Sodium EDTA
Sodium molybdate
Sodium pyruvate
Sodium selenite
Sodium Thiosulfate (and)
Sorbitol (
Streptomycin
Sucrose
Sulfuric acid
Tetracycline
Tetradecane 100%
Tetrahydrofuran
Thiamine.HC1
Thionyl chloride
Tin oxides. Dlatinum. Dalladium
Tobramycin
Tomaldehyde in PHEMD buffer
Tray-Vitek Fluconazole (Well 29) 0 ug/ml
Trehalose
TRIS, pH 7.5
Tris-HC1, pH 8.0
Tryptophan (Well 10)
Urea
Vancomycin
Xylitol
Xylose
Zinc carbonate
Zinc sulfate

To: Pete Rutledge <prutledg@hq.nasa.gov>
From: John P Castellano <jcastell@hq.nasa.gov>
Subject: Support to Bryan
Cc: snewman@hq.nasa.gov
Bcc:
Attached:

In status briefings Ron D. mentioned that during re-entry the Orbiter Flight Control System saw excursions that exceeded the family of previous experience but within the system margins utilizing elevon and RCS attitude control..The cause of these excursions was attributed to drag on the left wing..possibly due to missing tiles. Additionally it has been reported that the temperature rises measured at various locations (wheel well , left fuselage etc.) were in the neighborhood of 40-50 F not high enough to represent a structural problem.. Previous flights have come home with some very significant tile damage (dings) as well as some missing without causing a problem. Undoubtedly this previous experience is a factor in the analysis and belief that this mission (and potential damage) did not represent a threat to flight safety..

If we postulate that elevated temperatures (up to the point of loss of vehicle) be ruled out as the factor (thus precluding a structural failure) and that the drag on the left side was due entirely to the progressive loss of tiles (unzippering) then at some point in this unzippering the Flight control system authority to safely maintain attitude and control will be become insufficient...

Perhaps some of the Flight Control folks are already looking into running simulations to determine tile loss vs margins since it seems intuitive that at some point in tile loss that the attitude control system will be overwhelmed..and unable to compensate.

X-Sender:
Date: Sun, 2 Feb 2003 16:04:14 -0800
To: Michael Stamatelatos <mstamate@hq.nasa.gov>
From: _
Subject: Re: Report

Michael:
I will have hat report and the publications that came from it FEDEXed to you tomorrow.
Best,

A while ago, you wrote a report for NASA on the safety of the shuttle tiles. I do not know its exact title. We cannot find a copy of the report here at HQ. Therefore, I am asking you to send me a copy ASAP if possible.
I apologize for this urgent request.
I hope everything is well with you.
We are certainly having our work cut for us for the time being and for the near future.
Thanks, again.
Best regards,
Michael
****

Dr. Michael Stamatelatos
Manager, Agency Risk Assessment Program
NASA Headquarters - Mail Code QE
Office of Safety and Mission Assurance
300 E Street, SW
Washington, DC 20024
Phone: 202/358-1668 Fax: 202/358-2778
E-mail: Michael.G.Stamatelatos@nasa.gov
(Please note change in e-mail address)

****

"Mission success starts with safety"

****

Stanford University, Stanford CA 94305-4026 USA

****

Please Note: I do not systematically read email on weekends, when I am out of town, nor generally more than once a day otherwise. Please call if it is urgent.

X-Sender: snewman@mail.hq.nasa.gov
X-Mailer: QUALCOMM Windows Eudora Version 4.3.2
Date: Mon, 03 Feb 2003 16:49:46 -0500
To: mwetherh@hq.nasa.gov, fchandle@hq.nasa.gov, mstamate@hq.nasa.gov, mkowales@hq.nasa.gov, lsirota@hq.nasa.gov, dlengyel@mail.hq.nasa.gov, henry.hartt@baesystems.com, dvecellio@arescorporation.com, jcastell@hq.nasa.gov, swander@hq.nasa.gov, tom.Whitmeyer@hq.nasa.gov
From: J Steven Newman <snewman@hq.nasa.gov>
Subject: Fwd: NAVY CONDOLENCES ON THE LOSS OF COLUMBIA AND HER CREW
Cc: boconnor@hq.nasa.gov, jlloyd@hq.nasa.gov, prutledg@hq.nasa.gov

Q/ NNBE Colleagues / Team

Please find attached heartfelt condolences from our extended family at NAVSEA.

With Shared Sympathies
Regards/Steve

From: Ford Alfred H NSSC <FordAH@NAVSEA.NAVY.MIL>
To: "'Newman, Steve'" <snewman@hq.nasa.gov>
Cc: Angus Hendrick <HendrickAG@NAVSEA.NAVY.MIL>, Anthony Mullarky <MullarkyAJ@NAVSEA.NAVY.MIL>, Brian Hughitt <HughittBK@NAVSEA.NAVY.MIL>,

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Thomas Markey <MarkeyTJ@submepp.navy.mil>,
"Castellano, John"
<jcastell@hq.nasa.gov>,

"Newman, Steve" <snewman@hq.nasa.gov>,

"Wander, Steve" <swander@hq.nasa.gov>,

Thomas Van Petten <VanPettenTL@NAVSEA.NAVY.MIL>
Subject: NAVY CONDOLENCES ON THE LOSS OF COLUMBIA AND HER CREW
Date: Mon, 3 Feb 2003 15:07:19 -0500
X-Mailer: Internet Mail Service (5.5.2653.19)

 COLUMBIA.pdf

DEPARTMENT OF THE NAVY

NAVAL SEA SYSTEMS COMMAND
1333 ISAAC HULL AVE SE
WASHINGTON NAVY YARD DC 20376-0001

IN REPLY TO

3 February, 2003

Dr. Steven J. Newman
Office of Safety and Mission Assurance
National Aeronautics and Space Administration
Washington, DC 20546-0001

Dear Steve,

On behalf of all the Navy members of the NASA/Navy Benchmarking Exchange effort, I want to express the deep personal sadness we feel upon learning of the loss of the Space Shuttle COLUMBIA and her crew. Our heartfelt sympathies go out to the NASA family at this very difficult time. The Navy team members recognize what a rare privilege we have to be working with NASA. The NASA personnel we have encountered are some of the most competent, dedicated and remarkable people we have ever met. Please extend our condolences to all the fine people we have worked with at NASA Headquarters, Johnson Space Center, Kennedy Space Center and the other Centers across the country. We grieve with you, we stand by you, and we look forward to a continued relationship focused on helping one another.

Sincerely,

Alfred H. Ford, Jr.
Submarine Safety & Quality Assurance
Naval Sea Systems Command
NNBE Navy Team Lead

X-Authentication-Warning: spinoza.public.hq.nasa.gov: majordom set sender to owner-code-q using -f
X-Sender: jlloyd@mail.hq.nasa.gov
X-Mailer: QUALCOMM Windows Eudora Version 4.3.2
Date: Tue, 04 Feb 2003 09:37:49 -0500
To: code-q@lists.hq.nasa.gov
From: James Lloyd <jlloyd@hq.nasa.gov>
Subject: Senate Resolution 41 February 3, 2003
Sender: owner-code-q@lists.hq.nasa.gov

For your information; Senate is adjourned today in honor of the seven astronauts.


Senate Resolution 41 commemorate.doc

Jim

X-Authentication-Warning: spinoza.public.hq.nasa.gov: majordom set sender to owner-code-q using -f
X-Sender: jlloyd@mail.hq.nasa.gov
X-Mailer: QUALCOMM Windows Eudora Version 4.3.2
Date: Tue, 04 Feb 2003 10:00:47 -0500
To: code-q@lists.hq.nasa.gov, smadir@hq.nasa.gov
From: James Lloyd <jlloyd@hq.nasa.gov>
Subject: Email with JSC (Operational note)
Cc: stacey.t.nakamura1@jsc.nasa.gov
Sender: owner-code-q@lists.hq.nasa.gov

Email contact with JSC SMA folks will be difficult for most of today. All people are displaced because of the memorial. Phones are set to ring at the fire house where some of the people have been temporarily located. Stacey Nakamura's email may be the only one in SMA today that is operating according to Gary Johnson. This will be rectified as people are allowed back at their desks later this afternoon.

If you have anything of a time critical nature this morning assure Stacey is also on its distribution if you transmit electronically.

Jim

X-Sender: prutledg@mail.hq.nasa.gov
X-Mailer: QUALCOMM Windows Eudora Version 4.3.2
Date: Tue, 04 Feb 2003 10:37:24 -0500
To: James Lloyd <jlloyd@hq.nasa.gov>,
"Wayne R. Frazier" <wfrazier@hq.nasa.gov>, mstamate@hq.nasa.gov
From: Pete Rutledge <prutledg@hq.nasa.gov>
Subject: Re: Old shuttle risk study by Pate-Cornell
Cc: jlemke@hq.nasa.gov, jlyver@hq.nasa.gov

Jim,

We had already anticiapted the need for the report. Couldn't find it here. I asked Michael S. to call her. Should arrive today via FedEx. I hope our call didn't cause her to give a press conference!!

Pete

At 10:26 AM 2/4/2003 -0500, James Lloyd wrote:
I recall seeing the study and recall it being on workmanship and its relationship to goodness of tile application. The study also treats the risk in a probabilistic sense. Maybe Bill Loewy could do a search on the web if it might be available externally or on the servers if internally. I think it predates Bob Weinstock but I may be wrong unless it was worked through Vitro. I would bet it is somewhere where we might have all the supporting documents for risk assessment.

At 09:58 AM 2/4/2003 -0500, Wayne R. Frazier wrote:
Jack Mannix from legal just called me. They are looking for a 1990 study by Elizabeth Pate-Cornell at Stanford on Shuttle Risk Analysis. I think I remember Bob Weinstock working that from here out of Code Q funds. Does anyone have a copy. Apparently its getting some press.

Wayne
~~~~~~
Wayne R. Frazier
NASA Headquarters - Code QS
Office of Safety and Mission Assurance
Washington,DC 20546-0001
Ph: 202 358-0588 Fax: 202 358-3104
~~~~~~

"Mission success starts with safety"

Jim

Peter J. Rutledge, Ph.D.
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Acting Director, Review and Assessment Division
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e-mail: pete.rutledge@hq.nasa.gov

Mission Success Starts with Safety!