To: Eric, wayne.frazier@hq.nasa.gov, john.lyver@hq.nasa.gov, Mark_Kowaleski, prichard@mail.hq.nasa.gov, jlemke <jlemke@hq.nasa.gov>
From: Wilson Harkins <wharkins@hq.nasa.gov>
Subject: CAC Action
Cc: jim
Bcc:
Attached: U:\users\wharkins\DATA\Columbia\working.doc;

In response to a CAC action that Jim provided to me this morning I've taken several sources of data and have developed some basic talking points concerning safety and reporting procedures that are to be provided for a briefing book for the Administrator. Please look at these and make sure that the information I've assembled is correct and current. Also if you know of any other procedures that should be included let me know that as well. The due like everything else is ASAP so please take a look as soon as you can. Thanks.

v/r

Wil

## SAFETY AND REPORTING PROCEDURES

## SPACE SHUTTLE PROGRAM

- The Space Shuttle Program utilizes NSTS 08117, "Requirements and Procedures for the Certification of Flight Readiness (COFR)" to define the Space Shuttle Program (SSP) Flight Preparation Process (FPP). It defines the procedures for the Project Milestone Reviews, the Program Milestone Reviews and the Flight Readiness Review (FRR). It also defines the endorsement documentation required at the completion of the FRR, which provides the Certification of Flight Readiness (CoFR) for a specific flight.

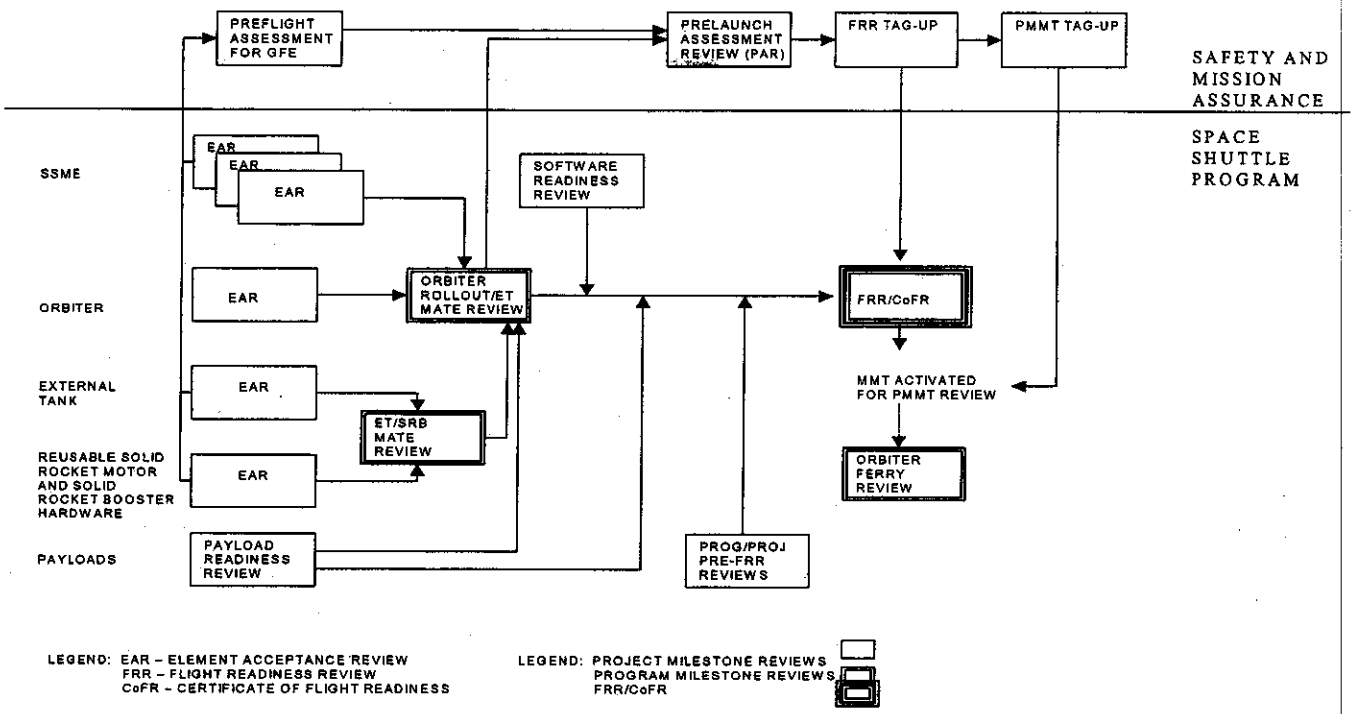
- NSTS 08117 is applicable to Johnson Space Center (JSC), Kennedy Space Center (KSC), Marshall Space Flight Center (MSFC), Stennis Space Center (SSC), and SSP NASA and contractor organizations and personnel involved in the conduct of Space Shuttle operations.

- The Flight Preparation Process (FPP):

    - The FPP consists of the preparations required for a Space Shuttle mission, from the baselining of the processing requirements to acceptance of the major hardware elements through processing, mating, launch, and when required, ferry.
    - Represents a commitment by each of the SSP element and project managers (NASA and contractor) certifying that their organizations have satisfactorily completed the requirements and their respective portions of the effort required to safely support each flight.
    - The FPP is structured to baseline a set of processing requirements through a series of requirements reviews and to incrementally review and status progress towards readiness for flight.
        - Progress toward readiness for flight includes the safety status incorporating information such as:
            - Departures from requirements
            - Resolutions of failures/corrective action implementation/approval
            - Safety Analyses/Hazard Analyses/Critical Items Lists
    - The FPP is incrementally implemented through a series of Project Milestone Reviews that lead to Program Milestone Reviews where elements of multiple projects are reviewed and culminates in the FRR that ensures the readiness of all organizations for the operational phase following each review.
        - The Project Milestone Reviews are the Element Acceptance Reviews (Space Shuttle Main Engine, Orbiter, External Tank, Reusable Solid Rocket Motor and Solid Rocket Motor Booster Hardware), the Payload Readiness Review (PRR), the Software Readiness Review (SRR), and the organizational Pre–FRR Reviews.
        - The three Program Milestone Reviews are the Pre–Mate Milestone Reviews, consisting of the External Tank (ET)/Solid Rocket Booster (SRB) Mate Milestone Review and the Orbiter Rollout/ET Mate Milestone Review, and a Ferry Flight Readiness Milestone Review which is conducted when a ferry is required.
    - The CoFR endorsement is signed at the FRR.

- A Prelaunch Mission Management Team (PMMT) Review will be conducted on the Launch Minus Two (L–2) Day or Launch Minus One (L–1) Day to status the launch countdown and address any issues remaining from the FRR.

- In addition to the CoFR process, the Safety and Mission Assurance organizations provide an independent communication avenue for monitoring safety. The Safety and Mission Assurance organization conducts Pre-Flight Assessments for Government Furnished Equipment (GFE) Shuttle Elements (Space Shuttle Main Engines, External Tank, Reusable Solid Rocket Motor) and subsequently a Pre-Flight Assessment Review (PAR) process for each space shuttle flight. The PAR process focuses specifically on assessing safety of flight issues and mission assurance issues. Examples of data that are assessed include:
  - Hazard Analysis
  - Launch Commit Criteria
  - NASA Safety Reporting System (NSRS)
  - Flight Rules/Crew Procedures
  - Software
  - Failure Modes and Effects Analysis/Critical Items List (FMEA/CIL)
  - Alerts system
  - Hardware Problems
  - Waivers/Deviations
  - In-Flight Anomalies
  - Operations and Maintenance Requirements/Limited Life Items
  - Certification
  - Configuration
  - Significant Nonconformances
  - Unexplained Anomalies
  - Cannibalization
  - Deferred Work
  - Training
  - Restricted Use Hardware




Space Shuttle Safety Reporting Processes

## NUCLEAR LAUNCH SAFETY REPORTING

- There is a safety reporting process related to the granting of Nuclear Launch Safety Approval (NLSA) for launching radioactive materials into space. This approval process is required by Presidential Directive/National Security Council Memorandum 25.
- The Nuclear Flight Safety Assurance Manager in the Office of Safety and Mission Assurance at NASA Headquarters works with Program Managers if radiological materials are being planned for launch.
- Assessment, approval and reporting requirements depend upon the possible radiological health effects due to prolonged exposure to the radioactive material. These effects are quantified using a value known as $A_2$.
- Depending on the amount of potential radiological health effects the following approvals/reporting takes place (listed from lowest risk to highest risk)
    - Radioactive Materials Report (RMR) prepared and assessed, NLSA granted via letter from the Nuclear Flight Safety Assurance Manager
    - RMR and mission description prepared and assessed, NLSA granted via letter from the Nuclear Flight Safety Assurance Manager and notification provided to the Office of Scientific and Technical Policy (OSTP) within the Executive Office of the President.
    - RMR, mission description, and radiological risk scope materials prepared and assessed, NLSA granted by the Associate Administrator for Safety and Mission Assurance and notification provided to the OSTP.
    - RMR, mission description, radiological risk scope materials, and Safety Analysis Summary prepared and assessed, NLSA granted by the NASA Administrator and notification provided to OSTP.
    - Safety Analysis Report prepared and evaluated by Interagency Nuclear Safety Review Panel, NLSA is granted by OSTP. Concurrently Radiological Emergency Preparedness Planning is initiated.

## MISHAP INVESTIGATION AND REPORTING

- The objective of NASA mishap investigation and reporting is to understand what happened (root cause) and prevent recurrence.
- NASA policy is to promptly release factual information concerning NASA mishaps to the news media and the public.
- Mishap investigation and reporting processes within NASA is governed by NASA Policy Document (NPD) 8621.1, "NASA Mishap Reporting and Investigating Policy" and NASA Procedures and Guidelines (NPG) 8621.1, "Procedures and Guidelines for Mishap Reporting, Investigating, and Recordkeeping."
- Mishap investigation and reporting process is overseen by Code Q to assure independence of mishap investigation process.
- NASA requires the development of mishap response plans and procedures at each organizational level.
- NASA requires quick and through investigation of mishaps allowing recommendations to be quickly implemented, which, in turn supports the Agency pursuit of mission objectives.
- Depth of investigation is determined by the severity of the mishap and the potential for reoccurrence.
- A formal acceptance and approval process is required (The Associate Administrator for Safety and Mission Assurance is the final approving authority for all Headquarters appointed mishap boards).
- A closed-loop system is used to track recommendations through completion and lessons learned are documented.
- An automated system, the Incident Reporting Information System (IRIS) is used to report and track mishaps.

## NASA SAFETY REPORTING SYSTEM

- Supplementary safety reporting system established after the Challenger shuttle mishap.
- This is an anonymous and voluntary reporting system for use when personnel:
    - have reported hazards locally and no action has been taken
    - are not satisfied with the response to a reported hazard
    - fear reprisal if they were to report the hazard through local reporting channels
- Reports are sent to an independent contractor who removes identifying information and then sends a summary of the concerns to the NASA Headquarters Office of Safety and Mission Assurance.
- NASA Headquarters Office of Safety and Mission Assurance assigns an action to conduct an investigation of the report.
- The report is then investigated and corrective actions are implemented.
- Report is closed by the Director of Safety and Risk Management in the Office of Safety and Mission Assurance at NASA Headquarters
- The Space Shuttle Program determines if any open NSRS reports apply to the Shuttle prior to launch

## NASA ADVISORY REPORTING

- Process for sharing data related to part and material problems and unsafe conditions across NASA programs, other government Agencies, and government related industry
- Data is identified as either a NASA Advisory or as a Government-Industry Data Exchange Program (GIDEP) failure experience document
    - NASA Advisory for release only within NASA.
    - GIDEP failure experience document used for concurrent release within NASA, other government Agencies, and industry.
- All NASA Advisories and GIDEP failure experience data is evaluated by all NASA programs to:
    - determine relevance of information to the program
    - identify and implement actions necessary to reduce or eliminate any detrimental program impacts
- NASA Advisories and GIDEP failure experience documents are evaluated by the Space Shuttle Program prior to launch

## Problem Reporting and Corrective Action

The Space Shuttle Program uses the following two documents for problem resolution:

- NSTS 08126, Problem Reporting and Corrective Action System Requirements
- NSTS 37325, JSC Orbiter Problem Reporting and Corrective Action Requirements

In summary:

- All problems must be interim dispositioned or closed prior to flight.
- All problems are also assessed to determine if the anomaly is a constraint to flight.
- Problems become "flight constraints" whenever the problem cannot be accommodated by one of the following:
  - Existing flight rules/crew procedures,
  - Basic subsystem redundancy,
  - Or has other implications that clearly present a safety of flight issue.
- The Space Shuttle Program Office and the Space Shuttle Program SR&QA Office is notified of the "flight constraint". The Problem Resolution Team and Management Team determine the follow-on actions required to clear the "flight constraint". Some of those activities (risk assessment) may include:
  - Test/Teardown and Evaluation
  - Failure analysis to understand the problem
  - Remedial or corrective action to correct the problem.
  - Analysis
  - Modeling
  - Simulation
- The rationale/resolution for clearing the "flight constraint" must be approved by the Space Shuttle Program Office and SR&QA Office.
- Problems that are not flight constraints are processed with interim or closed dispositions. Interim disposition is acceptable based on one of the following criteria:
  a. The problem is not applicable to the flight(s) (i.e., system not installed and/or used on the flight).
  b. The problem condition is clearly screened during preflight checkout or special tests.
  c. The problem is time/age/cycle related and the flight units will accumulate less than 50% of the critical parameter(s) by the end of the flight.
  d. There is no indication of a generic problem.
  e. There is no overall safety of flight concern.
  f. The problem is applicable to the flight(s) (system used during flight); however, the PRCB agrees that sufficient evidence exists that the system can be flown safely (acceptable risk).
- Reportable problems experienced after the SSP Flight Readiness Review (FRR) through completion of the element's mission phase or during a flight which could potentially affect flight, ground crew safety, or mission success will be reported to the appropriate Design

Element Office as soon as possible, but no later than one working day from detection. If the problem occurs preflight, it must be reported to the Design Element Office prior to launch. Design Element Office managers are responsible for reporting significant problems to the Program Requirements Control Board (PRCB) or Mission Management Team (MMT) to support launch or flight decisions.

To: Faith Chandler <fchandle@hq.nasa.gov>
From: Wilson Harkins <wharkins@hq.nasa.gov>
Subject: Re: Fwd: How's this? Courtesy of Nanette
Cc:
Bcc:
Attached:

Thanks Faith.

Copies of all three documents have been put in binders and were delivered to the 7th deck. Other binders are in the QMIC.

v/r

Wil

At 11:43 PM 2/1/2003, you wrote:
Wil,

Here is the NPG in a word document.
It is current.
We just got it from NODIS because it prints better than the one on the web.

~~~~~~~~~~~~~~~~~~~~~~~~

Faith Chandler

NASA Headquarters
Office of Safety and Mission Assurance
Code Q Rm 5x40
300 E Street, S.W
Washington, D.C 20546

202-358-0411
202-358-2778 (fax)

~~~~~~~~~~~~~~~~~~~~~~~~

To: jlemke <jlemke@hq.nasa.gov>
From: Wilson Harkins <wharkins@hq.nasa.gov>
Subject: Re: Team Questions
Cc:
Bcc:
Attached:

John,

While not specific questions or answers that might come from testimony the following two items come to mind. 1 Has anyone done a complete scrub of the Code Q webpages to make sure they are current? Out-of-date or erroneous information is like chum in the water to reporters and congressmen. We wouldn't want to be sucker punched by someone based on something we have posted. (I know that Eric has already talked to you about the NSRS stuff - do we have anyone else revalidating our webpages?) Second it seems like it is only a matter of time before some enterprising newshound or congressional staffer asks the question are you following the same procedures that you would follow if someone else was injured at NASA leading invariably to the request to look at the results of other mishap data - are our mishap files in order to be able to respond to that question? What about the follow-up question since you want to try to learn from mishaps how can the NASA workforce access this information for use (or how have you disseminated it?)

Just some thoughts.

v/r

Wil

At 08:49 AM 2/6/2003, you wrote:
At 07:25 AM 2/6/2003 -0500, you wrote:

John am I on the team to develop questions?

Everybody is on the team to develop questions **and** answers. I will forward everyone the "topics' outline we developed to organize the Q&As when I get the annotated topics. The annotation (or highlighting) will identify where Q&As are most wanted.

More to follow.

John Lemke
Manager, System Safety Engineering
NASA HQ, Code QS
202-358-0567 FAX 358-3104
jlemke@hq.nasa.gov
***"Mission success stands on the foundation of our unwavering commitment to safety"***
**Administrator Sean O'Keefe January 2003**

# Overview of NASA Mishap Investigation Policy and Process and Contingency Planning

**February 4, 2003**

**Jim Lloyd**
**NASA Headquarters**
**Office of Safety and Mission Assurance**



Michno

# Purpose

- To provide a top level overview of NASA Mishap Policies and Procedures and their connection to the ongoing contingency efforts for the STS-107 mishap

# NASA Policy and Procedures

- **NASA has policy and contingency planning in place to assure the proper investigation of all mishaps (including Space Shuttle)**
  - **NASA Policy Document (NPD) 8621.1, "NASA Mishap Reporting and Investigating Policy," October 02, 2002.**
  - **NASA Procedures and Guidelines (NPG) 8621.1, "Procedures and Guidelines for Mishap Reporting, Investigating, and Recordkeeping," June 2, 2000.**
- **Policy may be downloaded from:**
  http://www.hq.nasa.gov/office/codeq/doctree/doctreec.htm

# NPD 8621.1G, "Mishap Reporting and Investigating Policy"

**Office of Prime Responsibility :** Office of Safety and Mission Assurance (Code Q)

Bryan O'Connor, Associate Administrator

- Establishes NASA-wide policy for mishap reporting and investigating—signed by the Administrator.
- Applies to mishaps occurring during NASA operations involving NASA or contractor personnel, and/or when NASA equipment/property is involved.
- Describes purposes of mishap investigation, board appointment authorities, roles of responsible officials, board levels, and responsibilities for final report acceptance and approval.
- Requires all levels to have mishap response plans e.g. pre-mishap plans, contingency plans, in place for response to emergencies.

# NPG 8621.1G, "NASA Procedures and Guidelines for Mishap Reporting and Investigating and Recordkeeping"

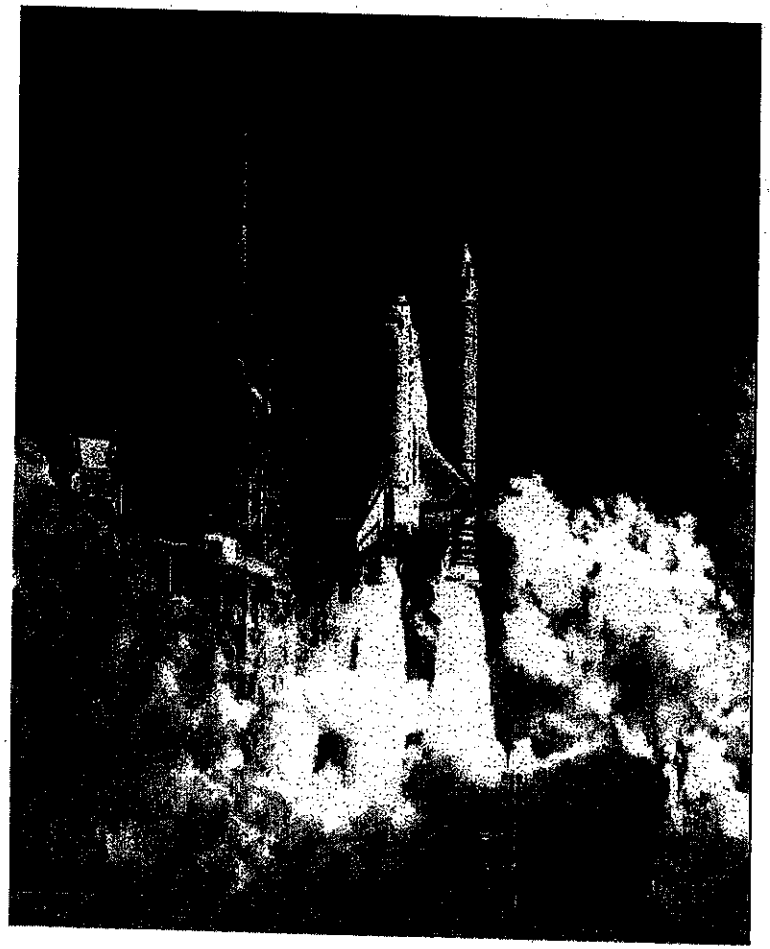
**Office of Prime Responsibility :** Office of Safety and Mission Assurance (Code Q)

Bryan O'Connor,
Associate Administrator

- Establishes NASA-wide procedures and guidelines for mishap reporting, investigating and recordkeeping-
- Provides definitions of types of mishaps; descriptions of reporting procedures, investigative techniques, report format, report timelines, report approval process, corrective action process, and lessons learned process.

# NASA Mishap Investigation Policy

- The objective of a NASA mishap investigation is to:
  - Gather information from the mishap investigation process and use as a key element of NASA's mishap prevention program.
  - That is, understand what happened (root cause) and prevent recurrence.
- The results of mishap investigations are not to be used in matters related to civil, criminal, or administrative culpability or liability, or for disciplinary actions.
- Witness statements given in the course of a NASA mishap investigation are treated as privileged and non-releasable (to the extent allowed by law)
- Mishap reporting and investigating process is overseen by Code Q to assure independence of process.



# Office of Space Flight
# Contingency Planning

## Special Considerations –OSF Contingency Planning

- NPD requires each level of organization to "develop mishap response plans, (e.g. pre-mishap plans,contingency plans, emergency response plans to ensure effective response to…emergencies….and mission failures."
- Office of Space Flight-Agency Contingency Plan for Spaceflight Operations, Nov 2002 establishes two mishap boards:
  - Establishes pre-designated, rapid response team trained in agency investigation policies with supporting working groups with expertise in specific Shuttle systems and operations. (Called Mishap Investigation Team or "MIT"-chaired by Dave Whittle of JSC)
  - Establishes a Standing Interagency board of senior personnel independent of NASA for Administrator level boards in the event of major mission failures or high visibility events in Space Flight Enterprise.

# 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

# STS 107 Mishap Interagency Standing Investigation Board

The board (renamed by Mr. O'Keefe as the Colombia Accident Investigation Board- CAIB) consists of a chair and seven members, supported by the Headquarters, NASA Field Centers, and technical consultants as required. Board Membership is as follows:

Chair Adm (ret) Harold Gehman Jr. (Washingon D.C.)

1. Maj. Gen. Kenneth W. Hess USAF Chief of Safety, (Kirtland AFB, NM)
2. Mr. Steven B. Wallace, FAA Director of Accident Investigation, (Washington, DC)
3. Maj. Gen. John L. Barry, Director Plans and Programs Air Force Materiel Cmd (Wright-Patterson AFB, CA)
4 Rear Adm. Stephen Turcotte, Commander, Naval Safety Center, (Norfolk, VA)
5. Dr. James N. Hallock, DOT Chief of Aviation Safety Division, (Cambridge, MA)
6 Brig Gen Duane Deal, Commander 21st Space Wing (Peterson AFB, CA)
7. Mr. G. Scott Hubbard, Director, Ames Research Center (Moffett Field, CA)

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

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

# Other Supporting teams to the CAIB

Independently assesses data and may conduct their own inquiries, tests, and actions.

**Columbia Accident Investigation Board**

**(CAIB)**

Coordination

Independent Board

NASA Led

FEMA
Homeland Security
EPA
DDMS
NTSB
FBI
FAA
Texas National Guard
Local Law Enforcement
U. S. Forest Service
Other agencies

Headquarters Contingency Action Team

Mishap Response Team

Membership: Mission Management Team (MMT)

Flight Crew Operations
Mission Opereations
Engineering
System Integration
Payloads & Cargo
MSFC Projects
Space & Life Sciences
Prime Contractors

Mishap Investigation Team

Orbiter

Emergency Operations Center

Data & Record Handling Team

External Tank
Solid Rocket Booster
Reuseable Solid Rocket Motor
Space Shuttle Main Engine

Rapid Response Team

KSC Ground Operations

# Back-Up Slides

# 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

- **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 (Faith to input new definitions here)

- **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.
- **Proximate 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.
- **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.

# NASA Strategy for Staffing MIB

- Type A Mishaps (death and/or damage, including mission failure equal to or exceeding $1M or selected high-visibility cases):
  - Administrator (or AA, Code Q) assigns a Board for the investigation or
  - Enterprise Associate Administrator (EAA) assigns a Board
  - Members require AA for Code Q concurrence to assure technical capability and independence.
- Type B Mishaps (personal disability or damage greater than $250K but less than $1M) and lesser mishaps – the Center Director or program executive will form the board.

# NASA Strategy for Staffing MIB

- Membership of an Mishap Investigation Board (MIB), team, or activity:
  - Chairperson (federal personnel)
  - Executive secretary (federal personnel)
  - *Ex officio* representative (federal person representing Code Q)
  - Board members (federal personnel only – odd number)
  - Members must have no vested interest in the outcome
  - All others duties of mishap board members are superceded by MIB activities.
  - Consultants
  - Observers, advisors and support staff
- Training -- investigators should have:
  - Completed the NASA mishap investigation course (or equivalent) and received refresher training every 3 years.
  - Sufficient experience and technical expertise.

**juanita.sandin@hq.nasa.gov, 11:48 AM 2/6/2003, Testimony Questions**

To: juanita.sandin@hq.nasa.gov
From: Wilson Harkins <wharkins@hq.nasa.gov>
Subject: Testimony Questions
Cc: Pete Rutledge <prutledg@hq.nasa.gov>, jlemke <jlemke@hq.nasa.gov>
Bcc:
Attached: U:\users\wharkins\DATA\Other Stuff\Questions for Testimony Preparation.doc;

Juanita,

Attached are additions for the list of questions being prepared to support upcoming testimony. The majority of these questions were derived from the list of questions prepared for Bryan's use. Let me know if you have any questions.

v/r

Wil

Questions for Testimony Preparation

Q. How has age of shuttles and shuttle components been monitored, tracked, mitigated and assessed for concerns such as corrosion, wearout, fatigue, obsolesence?

Q. Are there any areas that aren't covered by inspections prior to launch? If so what risk mitigations are in place for these areas?

Q. Are maintenance, inspection and test data kept and trended? Have there been any adverse trends or concerns in these areas?

Q. Have assessments/comparisons been made between telemetry data from the Columbia mission and all other shuttle re-entries?

Q. Were there any process/material/software changes made and implemented prior to this flight (or other recent flights)? How were these qualified/tested/evaluated? Has there been any trend data established that identifies the effectiveness of the changes or weaknesses in the processes/materials/software or resulting systems/equipment?

Q. What independent/external independent control processes were operative? What problems/concerns/changes were implemented based upon these control processes?

Q. Many independent reviews/assessments have been performed at many levels of the Agency and shuttle program have these been reviewed collectively for any trends?

Q. Given the fact that the crew did not have the capability to check tiles through an EVA, was the use of ground and/or satellite imaging considered to check the condition of tiles? If tiles are identified as damaged what options exist or have been considered to respond to the problem?

Q. There are a comprehensive series of reviews that take place prior to launch to determine flight readiness, are there any corresponding reviews performed to determine re-entry and landing readiness? If so, is the level of participation in these reviews the same as for the flight readiness reviews (i.e. the same level of decision makers, the same rigor applied, etc).

Q. Were the roles and responsibilities of Safety and Mission Assurance personnel and organizations clearly defined and understood prior to the mishap?

Q. What mechanism triggers actions taken to correct or improve inherent design weaknesses and improve design/materials/manufacturing?

Q. Were all of the safety recommendations from the Rogers Report and the McDonald report properly addressed/dispositioned/implemented by NASA? Has NASA allowed any subsequent process changes that have eroded previously implemented recommendations?

Q. How are potentially hazardous materials used on the shuttle identified and controlled?

Q. Are there any scenarios for shuttle operations that have not been considered in NASA risk considerations/models/PRA? If so what are they and why haven't they been considered?

Q. What is the pre-launch assessment process used to evaluate and accept shuttles for launch?

Q. What photographic and associated evaluation capabilities exist for launch and re-entry/landing? How are these utilized?

Q. What debris evaluations are conducted for launch/ascent, on-orbit operations, and re-entry landing? How are the results of these evaluations factored into mission decisions.

Q. What records/data are maintained for the condition and configuration of equipment (encompassing everything from tiles to structure, hardware and software)?

Q. Were there any process shortcuts (waivers/deviations) approved for this flight? If so, how are these processed and who approves them?

Q. How are the workers that work on the shuttle program, both Civil Service and Contractor, determined to be qualified to perform their work? What training is provided to these people?

To: Ashley Stockinger <astockin@hq.nasa.gov>
From: Wilson Harkins <wharkins@hq.nasa.gov>
Subject: Re: Fwd: CAC Code M, B, U, Q action required
Cc:
Bcc:
Attached:

Thanks for getting back to me. I'm working up some of the material but I still need to know if there is a specific format I need to follow for the book or is it freeform as long as it is legible and makes sense?

v/r

Wil

At 01:20 PM 2/10/2003, you wrote:
I have been working at another station and I am late in getting back to you on this. Has the answer already been provided to you, or do you still need me to get some guidance?

Sorry for the delay,
Ashley

At 09:52 AM 2/10/2003 -0500, you wrote:
Ashley,

I've been tasked in Code Q to help put together our portion of the book, do you have any guidance on format for the briefing book?

v/r

Wil

X-Sender: astockin@mail.hq.nasa.gov
X-Mailer: QUALCOMM Windows Eudora Version 4.3.2
Date: Fri, 07 Feb 2003 13:54:49 -0500
To: rdavis@hq.nasa.gov, hrothman@hq.nasa.gov, rcooper@hq.nasa.gov, dmcsween@hq.nasa.gov, dcomstoc@hq.nasa.gov, rstephen@hq.nasa.gov, mark.kowaleski@hq.nasa.gov, gmartin@hq.nasa.gov, jbingham@hq.nasa.gov, astockin@hq.nasa.gov, wbierbow@hq.nasa.gov, adiaz@hq.nasa.gov
From: Ashley Stockinger <astockin@hq.nasa.gov>
Subject: Fwd: CAC Code M, B, U, Q action required
Cc: HCATinfo@hq.nasa.gov

CAC Group:

As you all may know, a briefing book for the Administrator is being developed due tomorrow. Code P has divided the content of the book into the following areas:

- STS-107 crew & families
- Debris collection
- Investigation Status
- Gehman board
- NASA Budget
- Safety & Reporting Procedures
- ISS Future
- Science Impact
- Previous Reports on Shuttle, Tiles and External Tank
- Agency Program Impacts

It seems that a great deal of work is being done on this by many different people and on many different levels. So as not to duplicate our efforts I suggest the following:

Code M take action of STS-107 crew & families, debris collection, Investigation Status, Gehman board, and ISS Future
Code B take action of NASA Budget
Code Q/M take action of safety and reporting procedures
Code U take action of Science impact
Code M/Q take action of previous reports on Shuttle, Tiles and External Tank

A great deal of previously approved information about these topics can be found on the X drive under CAC in the resources file.

Any questions regarding these topics should be addressed to Code P CAC rep. Rich Cooper x1774

Thank you,
Ashley Stockinger

Ashley K. Stockinger
Office of Space Flight
NASA Headquarters
Phone: (202) 358-2397
Fax: (202) 358-2983

Jim

Ashley K. Stockinger
Office of Space Flight
NASA Headquarters
Phone: (202) 358-2397
Fax: (202) 358-2983

X-Authentication-Warning: spinoza.public.hq.nasa.gov: majordom set sender to owner-code-q using -f
X-Sender: prutledg@mail.hq.nasa.gov
X-Mailer: QUALCOMM Windows Eudora Version 4.3.2
Date: Sun, 02 Feb 2003 19:49:16 -0500
To: code-q@lists.hq.nasa.gov
From: Pete Rutledge <prutledg@hq.nasa.gov>
Subject: Supporting Bryan on the Columbia Accident Investigation Board (CAIB)
Sender: owner-code-q@lists.hq.nasa.gov

Code Q staff members,

As you may know Bryan is the ex-officio member of the Columbia Accident Investigation Board. He left for Barksdale AFB this afternoon around noon time. That is where he will meet up with the other CAIB members.

One of our main jobs in the immediate future will be to support him. We can support him in at least three ways: 1. We can respond to his requests. 2. We can collect, on our own initiative, data that could be of use to him (but we need to proceed most carefully on this one). 3. We can suggest questions or avenues of investigation that he might be able to inject into the work of the board.

Attached is a rough list we prepared today of investigative areas--for the most part these are areas in which the SMA community has some special expertise. For each area we have tentatively named an OSMA lead (and in some cases more than one person to work together). If you can think of other areas that we have not captured, and should, let me know. If we've associated you with the wrong area(s) or failed to associate you with the right area(s), let me know. We don't want to disrupt the investigation--we want to be prudent; we want to help Bryan. Think about whether and how you might be able to be helpful in these areas; then, before you take any action, write down your plan in a clear, concise manner, and send it to me--state what you might be able to do and how you would propose to do it. Then wait for a go-ahead from Jim or me. Keep in mind that we have asked the SMA directors at JSC, MSFC, KSC, LaRC, ARC, and SSC to work with us as needed, so this can be part of your plan, if appropriate.

We have also asked all 10 SMA directors to think of questions or issues that Bryan might pursue with the CAIB. I will be collecting these inputs. Your questions and issues are solicited, as well. Put your investigator hat on, think about this, do your own personal fault trees and hazard analyses, send me your ideas. I'll collect them up, as well, to send to Bryan.

Let's do a great job for Bryan on this important matter.

Thanks,

Pete


OSMA Support to Bryan O.doc

---

Peter J. Rutledge, Ph.D.
Director, Enterprise Safety and Mission Assurance Division
Acting Director, Review and Assessment Division
Office of Safety and Mission Assurance
NASA Headquarters, Code QE, Washington, DC 20546

ph: 202-358-0579
FAX:202-358-2778
e-mail: pete.rutledge@hq.nasa.gov

***Mission Success Starts with Safety!***

As of: February 2, 2003

SMA Support to Bryan O'Connor as Ex-Officio member of Space Shuttle Mishap Investigation Board (SSMIB)

| SMA-Related Investigative Area | Remarks | OSMA Lead |
|---|---|---|
| Hazard reports, Fault Trees, FMEA | Relates to work of Space Shuttle System Safety Review Panel (SSRP); especially pertaining to ET foam; e.g., impact on Orbiter | Mark K., Bill B. |
| Risk | Accepted risks for this mission? | Mark K., Bill B. |
| Payload safety (as cause of mishap) | Relates to work of Payload Safety Review Panel (PSRP). Interest includes potential for hazardous payloads to have caused catastrophe.. | Mike Card, John Castellano |
| Payload safety (safety of recovery) | Includes radiological and other hazardous payload contents | John Lyver/Gil White |
| Problem trends (HW/SW) | Relates to Problem Reporting and Corrective Action (PRACA); initially PRs dealing with ET foam problems may be of most interest? | Paul Boldon (SW PRs), Mark K., Bill B. (HW PRs) |
| Quality | Material Review Board actions, repairs, etc., initially especially in regard to foam and tile installation and repair; contractor/supplier surveillance | Tom Whitmeyer |
| Probabilistic Risk Assessment (PRA) | Initial interest includes 1990 Pate-Cornell PRA of Shuttle tile installation process, as well as current Shuttle PRA | Michael Stamatelatos |
| Pre-launch reviews | Includes Pre-launch Assessment Reviews, Mission Safety Evaluations, waivers, deviations, rules changes, limited life items, etc. | Mark K., Bill B. |
| Expected casualty, Ec (post-mishap) | Includes collecting/using data from this mishap to calculate Ec for Shuttle re-entry | Pat Martin (with Maria Tobin) |

| | | |
|---|---|---|
| Software hazards | Includes software changes, software hazard analysis | Paul Boldon, Sharyl Butler (JSC), Martha Wetherholt, IV&V Ctr |
| SMA Policy | Emergency Preparedness, system safety, R&M, mishap investigation, etc. | Wil Harkins, Jon Mullin |
| Contingency Planning | A post-mishap look at correctness/effectiveness of our contingency plans; do we need updates/changes? | Gill White |
| NASA Safety Reporting System (NSRS), Alerts | Includes any NSRS reports or alerts pertaining to foam, tile, ingredients, etc., as well as any current Shuttle-related reports | Eric Raynor |
| Lessons Learned | Are there any pertinent LL in the database? Ensuring that these new lessons get into the LLIS in the long run. | Eric Raynor |
| SMA Reviews and Assessments | OEP, PV, FMR spot checks, staff assistance visits, other periodic center visits (including MAF) | Steve Newman, Art Lee, John Lyver |
| Aerospace Advisory Panel | Includes any pertinent findings | Len Sirota |
| Training | Of workers on the floor—certification and training for insulation application, repair, etc. | Eric Raynor |
| Life extension program | We were about to benchmark what USAF does for aging aircraft. Any implications for what NASA does? | Tom Whitmeyer, SLEP Panel (Obs.& Sustainment), Bill Bihner, John Castellano |
| Mishap Investigation protocol and methodology | Supporting with info on NPDs, NPGs, root cause methods, training for MIB members, briefing packages, etc. | Wayne Frazier, Faith Chandler |
| Human Factors | What opportunities were there for human factors to contribute to the mishap? | Faith Chandler |

| | | |
|---|---|---|
| Post-mishap implications for ISS | Keeping up-to-date information on affect of this mishap on ISS supportability, etc. | Rich Patrican, Gil White |
| MIB Web-based work group area | PBMA work group to support information and communication needs of the MIB, including IT security of the posted/transmitted information | Steve Newman, Steve Wander |
| DoD data | Data that DoD might have that could be useful | Mike Card |
| Space Shuttle Manufacture | Background and details of the manufacturing process. | Len Sirota |

X-Sender: jmullin@mail.hq.nasa.gov
X-Mailer: QUALCOMM Windows Eudora Version 4.3.2
Date: Mon, 03 Feb 2003 10:57:26 -0500
To: prutledg@hq.nasa.gov
From: "Jonathan B. Mullin" <jmullin@hq.nasa.gov>
Subject: OSMA Support to Bryan O'Connor as
Ex-Officio member of Space Shuttle Mishap Investigation Board (SSMIB)
Cc: Matthew Gaier <mgaier@hq.nasa.gov>, wharkins@hq.nasa.gov,
eraynor@hq.nasa.gov, jlemke@hq.nasa.gov

Pete, some recommendations in to the assignments are indicated in Yellow. I think we need to add some Flight (Aviation Safety) into the tasked areas. I would recommend that we do a priority listing of the enclosed topics. Perhaps there is a need to coordinate some of our areas with Code AM as they may overlap, such as Human Factors.

Regards, Jon

Jonathan B. Mullin
Manager Operational Safety
Emergency Preparedness Coordinator
Headquarters National Aeronautics and Space Administration
Phone (202) 358-0589
FAX (202) 358-3104
"Mission Success Starts with Safety"


OSMA Support to Bryan O1.doc

As of: February 2, 2003

SMA Support to Bryan O'Connor as Ex-Officio member of Space Shuttle Mishap Investigation Board (SSMIB)

| SMA-Related Investigative Area | Remarks | OSMA Lead |
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| | | |
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| Software hazards | Includes software changes, software hazard analysis | Paul Boldon, Sharyl Butler (JSC), Martha Wetherholt, IV&V Ctr |
| SMA Policy | Emergency Preparedness, system safety, R&M, mishap investigation, etc. | Wil Harkins, Jon Mullin, [redacted] |
| Contingency Planning | A post-mishap look at correctness/effectiveness of our contingency plans; do we need updates/changes? | Gill White, [redacted] |
| NASA Safety Reporting System (NSRS), Alerts | Includes any NSRS reports or alerts pertaining to foam, tile, ingredients, etc., as well as any current Shuttle-related reports | Eric Raynor |
| Lessons Learned | Are there any pertinent LL in the database? Ensuring that these new lessons get into the LLIS in the long run. | Eric Raynor |
| SMA Reviews and Assessments | OEP, PV, FMR spot checks, staff assistance visits, other periodic center visits (including MAF) | Steve Newman, Art Lee, John Lyver, [redacted] |
| Aerospace Advisory Panel | Includes any pertinent findings | Len Sirota |
| Training | Of workers on the floor—certification and training for insulation application, repair, etc. | Eric Raynor, [redacted] |
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| Mishap Investigation protocol and methodology | Supporting with info on NPDs, NPGs, root cause methods, training for MIB members, briefing packages, etc. | Wayne Frazier, Faith Chandler, [redacted] |
| Human Factors | What opportunities were there for human factors | Faith Chandler, [redacted] |

| | | |
|---|---|---|
| | to contribute to the mishap? | |

| | | |
|---|---|---|
| Post-mishap implications for ISS | Keeping up-to-date information on affect of this mishap on ISS supportability, etc. | Rich Patrican, Gil White |
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| DoD data | Data that DoD might have that could be useful | Mike Card |
| Space Shuttle Manufacture | Background and details of the manufacturing process. | Len Sirota |

X-Authentication-Warning: spinoza.public.hq.nasa.gov: majordom set sender to owner-code-q using -f
X-Sender: dmoore@mail.hq.nasa.gov
X-Mailer: QUALCOMM Windows Eudora Version 4.3.2
Date: Tue, 04 Feb 2003 14:38:07 -0500
To: code-q@lists.hq.nasa.gov
From: Dale Moore <dmoore@hq.nasa.gov>
Subject: Accident Investigation Cost Accounting
Sender: owner-code-q@lists.hq.nasa.gov

This is the current guidance for tracking investigation costs. There is no way to track labor costs at HQ, but Codes C & B are working on a separate code to use for travel expenses. In the meantime if you are traveling as part of the investigation, please make a note in the purpose section of the travel order that you are traveling to support the Columbia accident investigation.

X-Authentication-Warning: spinoza.public.hq.nasa.gov: majordom set sender to owner-code-q using -f
X-Sender: prutledg@mail.hq.nasa.gov
X-Mailer: QUALCOMM Windows Eudora Version 4.3.2
Date: Tue, 04 Feb 2003 09:52:27 -0500
To: code-q@lists.hq.nasa.gov
From: Pete Rutledge <prutledg@hq.nasa.gov>
Subject: Information we prepare and provide in support of HCAT and/or the MIT/CAIB
Sender: owner-code-q@lists.hq.nasa.gov

Code Q staff members,

Please make sure Jim or I get to see and initial off on any new material we prepare for the HCAT and/or the MIT/CAIB. This is not necessary when responding to a request for copies of existing material that has already had management approval in the past. When seeking management buy-off on new material, please bring two copies; one will go to Pam Richardson, who is keeping the official collection of what we have done. When providing existing material, it would be helpful if you would at least let Pam know what you provided (no copy needed as long as you identify it), so that we will have a complete record of what goes out.

Thanks,

Pete

---

Peter J. Rutledge, Ph.D.
Director, Enterprise Safety and Mission Assurance Division
Acting Director, Review and Assessment Division
Office of Safety and Mission Assurance
NASA Headquarters, Code QE, Washington, DC 20546

ph: 202-358-0579
FAX:202-358-2778
e-mail: pete.rutledge@hq.nasa.gov

***Mission Success Starts with Safety!***

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 08:46:46 -0500
To: prichard@hq.nasa.gov, prutledg@hq.nasa.gov,
Bill Bihner <wbihner@mail.hq.nasa.gov>
From: James Lloyd <jlloyd@hq.nasa.gov>
Subject: CAC
Cc: code-q@lists.hq.nasa.gov,
"Dr. Michael A. Greenfield" <michael.greenfield@hq.nasa.gov>
Sender: owner-code-q@lists.hq.nasa.gov

Dr. Greenfield is instituting a process for the collection of technical questions and answers and will serve as NASA's technical clearinghouse for release to the outside community. He will be providing details on how this information is to be collected and dispositioned. He has set up an action center (referred to as the CAC) and will chair a meeting each day at 2 pm (location to be provided shortly). Bill Bihner is the Code Q representative and will be attending the meeting starting this afternoon.

I have briefed Dr. Greenfield on our process for providing a list of questions to the CAIB. We will also be involved with supporting Bill Bihner and Dr. Greenfield in developing answers to technical questions where Code Q is the obvious source for the answer. We will also be allowed to review technical answers developed by others as part of the process for Dr. Greenfield's approval for release.

Jim

X-Authentication-Warning: spinoza.public.hq.nasa.gov: majordom set sender to owner-code-q using -f
X-Sender: dmoore@mail.hq.nasa.gov
X-Mailer: QUALCOMM Windows Eudora Version 4.3.2
Date: Mon, 03 Feb 2003 15:53:22 -0500
To: code-q@lists.hq.nasa.gov
From: Dale Moore <dmoore@hq.nasa.gov>
Subject: Weekend Hours
Sender: owner-code-q@lists.hq.nasa.gov

We received the following guidance from Payroll on recording hours worked over the weekend:

Credit hours can only be earned Monday through Friday, but the options listed below are available to all full time employees regardless of work schedules (Regular Time, Compressed Time, Flexitime.)

1. Volunteer hours are recorded as FRFT.
2. Compensatory Time
3. Overtime (with supervisor's approval)

   Pay may not exceed the pay of a 15/10 during the 2 week pay period.

X-Authentication-Warning: spinoza.public.hq.nasa.gov: majordom set sender to owner-code-q using -f
X-Sender: jlyver@mail.hq.nasa.gov
X-Mailer: QUALCOMM Windows Eudora Version 4.3.2
Date: Thu, 06 Feb 2003 12:04:34 -0500
To: Code-Q@Lists.HQ.NASA.GOV
From: "John W. Lyver, IV" <jlyver@hq.nasa.gov>
Subject: **HOT** OSMA ALL HANDS MEETING THURSDAY: Topic Areas for Safety and Mission Success/Assurance Questions and Answers
Sender: owner-code-q@Lists.HQ.NASA.GOV

# *** HOT HOT HOT ***

**From Pete and Jim**

1) There will be an OSMA ALL HANDS meeting IMMEDIATELY following the 1pm SMA Directors telecon in the QMIC, today, Thursday, 2/6/03.

2) Attached is the second cut at the Questions/Answers crib sheet for helping Mr O'Keefe prepare for SMA portion of the Congressional testimony next week. PRINT OUT the file BEFORE the meeting if you can.

3) Pete will instruct all hands on what is needed to fill in the charts on the attachment. Basically here's a summary of what Pete's going to tell you:

- **Bolded** headings are the areas to concentrate on.
- The tables for each SMA topical area are presented like JEOPARDY. We've listed the answers in the right hand column. Your job is to come up with the questions for the left hand column. Mr. O'Keefe will be playing Double Jeopardy with them next week on the Hill.
- The answers are a first cut from the DRAFT SMA Requirements Model. Do NOT consider this list as complete and final. It may be appropriate to expand, combine, delete, add, fix, .... some of the answers. Your comments will also be considered for incorporation into the SMA Requirements Model.
- If your name is next to a heading, then you are the JEOPARDY Player who has been asked to to fill in the questions for the table below that heading. If your name is next to a line on a table, then you only need to 'Question' that item.
- Here's what we need you to turn in:
  - = **All questions are due by COB Thursday, 2/6/03**. If you can't get it done today, see Pete. (We're worried about getting snowed in and meeting Michael Greenfield's Friday suspense for a completed response.)
  - = Handwritten filling in the tables is preferred. Please use something other than black ink. You are welcome to write the questions in the left hand column, line out where items are deleted, add yellow sticky notes where you want to add stuff, ... (Beauty does NOT count, just as long as I can read them!)
  - = Please put your name on the top of the first page so we know whose comments are whose.
  - = Your welcome to develop any questions for any of the other answers beyond what you were assigned, if you have time.

*** PLEASE put the completed Question Sheets in the envelope on my door.***

If you have any questions, ask Pete.

THANKS!!
Pete and John

030206 noon - Topic Areas for Safety and Mission Success.doc

**********

John W. Lyver, IV - C.S.P.
NASA Headquarters - Code QV
Office of Safety and Mission Assurance
Washington, DC 20546-0001
(w) 202/358-1155 (fax) 202/358-3104

*"Safety vigilance is not negotiable, lives are at stake"*

**********

# Topical Areas for Safety and Mission Success/Assurance

## Questions and Answers

**Saturday, Feb 8, 2003 5pm Version**

# Topical Areas for Safety and Mission Success/Assurance Questions and Answers

Throughout this collection of questions and answers, the term "Safety" is used to mean, and in place of, the term "Safety and Mission Assurance (SMA)"

## Table of Contents of Question Areas


POLICIES, PROCEDURES, GUIDELINES, AND STANDARDS ..... 2
- Policy Development ..... 2
- Requirements Implementation ..... 2

MANAGEMENT LEADERSHIP & EMPLOYEE INVOLVEMENT ..... 3
- Management Leadership, Commitment, And Involvement ..... 3
- Responsibility, Accountability, Authority, Resources (People, Money), And Organization ... 4
- Program Planning, Schedule, Planned Upgrades ..... 6
- Contractual Instruments, Flow-Down, Insight, Oversight ..... 7
- Motivational, Promotional, Awareness Activities ..... 8
- Internal Studies And External Reviews ..... 10

HAZARD AND RISK MANAGEMENT ..... 11
- Risk Management ..... 11
  - Risk Identification And Mitigation ..... 11
  - Risk Tracking ..... 13
  - Lessons Learned ..... 13
  - Personnel Reliability Program (PRP) ..... 14
- Software Assurance ..... 14
  - Software Risk Management/Tools/Plans ..... 14
  - Software Flight Readiness/Certification ..... 14
  - Software Requirements ..... 14
- Emergency/Contingency Preparedness ..... 14
  - Emergency Preparedness ..... 14
  - Hazardous Materials (Radiation, Toxics, Energetics) ..... 15

HAZARD AND RISK ASSESSMENT ..... 15
- Probabilistic Risk Assessment ..... 16
- NASA Safety Reporting System (NSRS) ..... 22
- Problem, Failure, Near-Miss, Mishap Reporting, And Root Cause Investigation ..... 23
- Product/Service Assurance Analysis And Product Protection ..... 25
  - Development, Manufacturing, and Operational Surveillance ..... 25
- Shuttle Payload Safety ..... 25
- Independent Activities And Assessments ..... 27
  - Process Verification and Program Oversight ..... 27

# POLICIES, PROCEDURES, GUIDELINES, AND STANDARDS

## Policy Development

| | |
|---|---|
| • Who approves NASA safety policies? | • NASA Policy Directives explain the policy and why it exists and are approved by the Administrator. NASA Procedure and Guideline Documents explain how to apply the policies and are approved by the Associate Administrator for Safety and Mission Assurance. |
| • What are NASA safety requirements based on? | • Safety requirements conform with and complement federal, state, and local laws and regulations; applicable executive branch direction; and NASA policy.<br>• Customer needs and requirements, as well as lessons learned (from past experience – good and bad), and preferred practices are incorporated into safety policy documentation. |
| • How are NASA policy documents made available to employees and contractors? | • Safety policies and procedures are available to all personnel via an Agency-wide electronic library (NODIS: NASA On-line Document Information System). |
| • How does NASA safety policy apply to contractors? | • NASA makes safety policy applicable to contractors through their contracts. |
| • Who approves exceptions, waivers, and exemptions from safety Policies? | • Exceptions, waivers, and exemptions to established policies are approved at the same level as the policy (unless policy allows for lower level approval) and they are documented. |
| • How would you describe a robust safety program? | • A robust safety program has the following qualities:<br>✓ Management commitment and employee involvement<br>✓ System and worksite hazard analysis<br>✓ Hazard prevention and control<br>✓ Safety and health training |

## Requirements Implementation

| | |
|---|---|
| • How is NASA assuring that safety policies are properly executed by NASA Centers & Contractors? | • NASA Headquarters Safety and Mission Assurance periodically surveys the NASA Centers to verify the adequacy of safety processes.<br>• The Centers in-turn survey the contractors for compliance.<br>• In addition, the NASA Inspector General plays an integral part in the "checks and balances" process.<br>• The NASA Aerospace Safety Advisory Panel (ASAP) independently monitors the strength of the safety of human spaceflight activity. |

| | |
|---|---|
| • What did NASA do to monitor the safety of the human space flight program when program management was moved from NASA Headquarters to JSC and Shuttle ground processing was transitioned to the United Space Alliance? | • Consistent with federal acquisition policy, NASA moved to a "best commercial practices" relationship with the private sector.<br>• NASA transformed our approach from oversight to insight. This reduced the government's direct interaction with contractors, while retaining visibility into their performance and better allowing the private sector to do what it does best.<br>• Because of these changes, in 1996, as an additional safety measure, the Associate Administrator for Safety and Mission Assurance formed the Human Exploration and Development of Space (HEDS) Assurance Board (HAB) comprised of the Safety and Mission Assurance Directors from the human space flight centers, a payload safety representative, an astronaut crew safety representative, and a Space Shuttle Program representative. From the outset, the HAB was to be in existence only during the period of Shuttle Program transition. The HAB met monthly from 1996 until mid-2002 to communicate, coordinate, and solve human space flight safety concerns. During that period, the HAB periodically met with and advised the NASA Administrator on safety matters. |
| • Why was the Human Exploration and Development of Space (HEDS) Assurance Board (HAB) deactivated last year? | • In mid-2002, feeling that the transition had reached a steady-state condition, regular HAB meetings were discontinued and it reverted to an on-call status. In late January 2003, we were planning to call a HAB meeting in the next couple of months to discuss the need for continued safety vigilance in light of push to meet the February 19, 2004, goal for core completion of the International Space Station. |

# MANAGEMENT LEADERSHIP & EMPLOYEE INVOLVEMENT

## Management Leadership, Commitment, And Involvement

| | |
|---|---|
| • What is the role of senior management in NASA's safety program? | • Senior management conspicuously promotes safety. They also provide resources, advocacy, leadership, policy direction, functional management, integration, and coordination for mission success. |
| • What is the role of the Associate Administrator for Safety and Mission Assurance? | • The Associate Administrator for Safety and Mission Assurance is NASA's chief advocate for safety, and serves as an independent advisor to the Administrator and the Enterprises.<br>• The Associate Administrator for Safety and Mission Assurance serves as the functional manager for safety, mission success, and the associated disciplines. |

| | |
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| • What is the role of line management in NASA's safety program? | • Line management communicates fundamental safety and mission success requirements to employees, manages the continuous implementation, and assures that they are understood.<br>• Supervisors are personally responsible for the safety and health of their workers |
| • How is NASA assuring excellence in safety activities? | • Management is taking steps to achieve/maintain world-class and have it third party certified by the Department of Labor as a under OSHA's Voluntary Protection Program and registration to ISO 9001 or AS 9100. |

**Responsibility, Accountability, Authority, Resources (People, Money), And Organization**

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| • What authority does Safety have in the Shuttle launch decision process? | • The safety organization has the authority to terminate any operation that presents an immediate an unacceptable risk to personnel, property, or mission operations. A safety representative participates in every aspect of the launch decision process, including the review of special issues or topics related to a specific flight or the shuttle fleet in general. The safety community representative signs the Certification of Flight Readiness (COFR) document at the Flight Readiness Review (FRR). The signature confirms that all requirements of the Flight Preparation Process (FPP) have been satisfied and that all required products have or will be produced and completed prior to launch. The OSMA Associate Administrator signs as concurring, from an independent assessment perspective, with the conduct of the COFR process and the critique of the data that has been presented for supporting flight readiness.<br>• A similar process applies throughout the Shuttle mission. |
| What is the structure of NASA Safety organization? | • The Associate Administrator for Safety and Mission Assurance reports directly to the NASA Administrator.<br>• The Safety and Mission Assurance Directors at the Centers report to the Center Director (except LaRC), which is outside of the program reporting chain. This direct access to the Center Director provides the authority needed to manage Safety efforts.<br>• The safety organization is independent of the program offices (e.g.; NSTS, ISS) so it is well positioned to provide objective nonadvocate reviews and assessments of safety processes and implementations of requirements.<br>• Center Safety and Mission Assurance Directors have an independent reporting path to the Associate Administrator for Safety and Mission Assurance, so that they can be assured safety concerns are addressed. |

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| • Who is accountable for safety? | • Managers are accountable for the safety of their programs.<br>• Supervisors are accountable for the safety of their workers.<br>• Workers are accountable for performing their jobs in a safe manner and adhering to all prescribed safety rules and procedures.<br>• The safety organizations are accountable for independent check and assurance. |
| • Where is safety accountability documented? | • This is established in NASA Policy Directive 1000.3, "The NASA Organization" for Officials-in-charge of Headquarters and Centers. Also, Enterprise Associate Administrators are responsible for implementing safety in their areas of control.<br>• Safety responsibilities are further emphasized in NASA Policy Directive 8700.1, "NASA Policy for Safety and Mission Success," to hold managers accountable for safety within their areas. |
| • How does NASA allocate resources to safely accomplish missions? | • Responsibility for compliance with safety policies is placed on each organizational element including the allocation and maintenance of appropriate levels of authority, budgeted resources, and training. Budgeted resources include people, equipment, safety tools, and facilities. |
| • How does the safety community identify and communicate its resource needs? | • Each Center documents safety resource needs in Center Annual Operating Agreements, which are reviewed and approved by the Center Director, and Enterprise Associate Administrator, and concurred by the Associate Administrator for Safety and Mission Assurance. As a part of this process, Centers are asked annually to identify to Headquarters any resource shortfalls. |
| • How did the budget tightening and downsizing of NASA in the 90's affect the way NASA assures Safety and Mission Success? | • It caused NASA to transform its safety process from an environment where one organization felt responsible for Safety and Mission Success, to an environment where everyone involved knows they have that responsibility. |
| • Has NASA's downsizing impacted the Agency's ability to conduct its programs and operations safely? | • Throughout the downsizing activity, NASA has upheld its responsibility to assure that safety would not be compromised. Safety staffing and resources surveys are periodically conducted to maintain an up-to-date picture of Agency wide safety resources. Safety and Mission Assurance Directors from across the Agency meet quarterly to discuss concerns, share best practices, and report status of safety efforts. These meetings provide an open forum for Center Directors to raise any issues they have regarding safety, including resources concerns. To date, no Safety and Mission Assurance Director has indicated that the safety function was so understaffed that it would not be able to perform the job.<br>• A current safety staffing study is underway. |

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| • How does NASA assure that safety resources are adequate? | • Enterprise Associate Administrators and Center Directors review safety resources and level of safety involvement in programs. (Annual Operating Agreements are used to advocate for additional funding.)<br>• Headquarters Office of Safety and Mission Assurance reviews Center safety resources during Process Verification reviews at Centers. |
| • What effect has the Space Flight Operations Contract (SFOC) had on Shuttle safety? | • NASA's expectation has always been that contractors perform to the contract and understand the risk. The Shuttle Program has always been contractor resourced. |
| • Does NASA follow OSHA regulations? | • Yes, NASA implements and complies with OSHA regulations. In order to enhance OSHA requirements NASA has numerous safety directives including alternate and supplemental standards.<br>• Several NASA Centers are 'Star Certified' to OSHA's Voluntary Protection Program (VPP). |
| • How does NASA assure that special safety functions are appropriately managed? | • NASA designates individuals or groups to advocate and manage special safety functions. Examples include: Aviation Safety Officer, System Safety Engineer, and Range Safety Officer. |
| • Did NASA's response to the Columbia accident follow an established plan? | • Immediately after the mishap, NASA implemented its Agency Contingency Action Plan for Space Flight Operations "by the numbers" and incorporated Emergency Preparedness Response activities as the Rapid Response deployed. A strong NASA Emergency Infrastructure provided for an effective Rapid Response Force. Plans were in place and defined specific responsibilities. Local, state, and federal responders supported NASA in this National Emergency in a stellar manner. |

## Program Planning, Schedule, Planned Upgrades

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| • What do NASA programs do to plan and implement safety? | • NASA programs and projects develop and maintain Safety and Mission Assurance program plans which:<br>• Reflect established policies and regulations and are successful results-oriented and measurable. Measurements are contained in the plans.<br>• Are prepared for all facilities/workshops and the programs/projects at the facility.<br>• Address development, testing, operations, and contingency/emergency operations.<br>• Address all the applicable elements in ISO 9001.<br>• Recognize and document customer needs.<br>• Are periodically reviewed and updated as they mature. |

## Contractual Instruments, Flow-Down, Insight, Oversight

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| • How does NASA assure safety and quality on procured products and services? | • NASA establishes and verifies performance requirements, including safety, for all purchased products and services. Where acceptable, NASA uses commercial standards.<br>• NASA expects contractors comply with OSHA and protect their employees while working on NASA contracts.<br>• NASA reviews safety requirements in service and engineering contracts prior to implementation if these contracts involve risk to NASA or its workers.<br>• NASA specifies quality requirements for acceptance of all products. |
| • Did a reduction in government quality inspections contribute to decreased safety or quality? | • No. Although there has been a gradual decrease in the number of government inspectors, this decrease was offset by the following:<br>✓ Advancement in technologies (automated processes for measuring, analyzing, improving, and controlling quality)<br>✓ Increased accountability imposed on contractors (increase in contractor quality accountability)<br>✓ Maturity of product design, operations, and processes. |
| • Has Shuttle safety and quality been decreasing recently? | • Measures of program safety and quality have indicated a steady improvement over the last few years:<br>✓ Reduction in frequency of launch delays, scrubs, and pad-aborts.<br>✓ Decreases in In-Flight Anomalies (IFA) and Unsatisfactory Condition Reports |
| • Did the change from government standards to industry standards cause a decrease in safety margins? | • For high criticality activities, such as the Shuttle Program, NASA has always maintained a significant degree of safety and quality expectations that include specific requirements for inspection, document retention, failure notification, control of design changes, and the disposition of hardware non-conformities. Adoption of industry standards has allowed NASA to take advantage of industry capabilities and "third-party" assessment activities; however, NASA continues to maintain tight control over contract quality expectations. NASA has recently adopted a new aerospace standard for quality systems (AS 9100), which will further increase the quality expectations of the NASA supply base. |

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| • Did the switch from government oversight (direct inspection) to government insight (indirect monitoring) reduce the margin of safety? | • During the mid-90s, there was a NASA-wide activity to re-allocate the use of mandatory inspection points. Established criteria was used to ensure that critical inspections would continue, and that reductions would be limited to non-critical activity or activity where duplicative inspections had been created over a period of time. This re-allocation effort allowed the government to focus its inspection activity and also enabled quality resources to be applied to monitoring of other quality indicators such quality system performance and the capability of critical processes. There continues to be a significant number of government inspections performed on NASA Programs (including Shuttle). Furthermore, because of the use of process and system monitoring, there are more quality performance data (wider range of data, more readily available) than previously available for review. |

**Motivational, Promotional, Awareness Activities**

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| • Does NASA have a documented, consistent system for evaluating performance, including rewarding exceptional performance and correcting unacceptable performance? | • NASA Procedure and Guidelines 3430.1A, NASA Employee Performance Communication System (EPCS), provides the specific procedures, methods, and requirements for planning, monitoring, and assessing employee performance in accordance with the NASA EPCS and applicable law and regulations. The EPCS places strong emphasis on the direct, one-on-one interaction between a supervisor and an employee.<br>• A consistent awards system is applied to all employees (including supervisors and managers).<br>• A consistent disciplinary system is applied to all employees (including supervisors and managers) who disregard the rules.<br>• Safety personnel are regularly recognized for outstanding contributions and are recommended for local and Agency-level awards to include SFA, QASAR, … |

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| • Does NASA reward employees and contractors for efforts taken to keep NASA people and property safe? | • Each year, NASA provides monetary exceptional performance awards to safety personnel who have demonstrated excellent performance in their jobs. In addition, there are several very high visibility award programs that recognized exceptional performance. They include the following:<br>✓ The Quality and Safety Achievement Recognition (QASAR) award recognizes NASA, other Government, and prime/subcontractor individuals for significant quality improvements to products or services for NASA, as well as safety initiatives within products, programs, processes, and management activities.<br>✓ The Space Flight Awareness Award Recognizes significant achievements leading to safe, cost-effective program modifications that increase reliability, efficiency, and performance to ensure mission success and human safety. This Award is applicable to employees from all NASA Centers, supporting Government agencies, private industry, and international organizations supporting human space flight programs.<br>✓ The NASA Flight Safety Award Recognizes significant contributions to flight safety for those space programs involving human flight. This Award is applicable to employees from all NASA Centers, supporting Government agencies, private industry, and international organizations supporting human space flight programs.<br>✓ NASA's George M. Low Award, designed primarily to recognizes NASA's prime and subcontractors for outstanding performance in the categories of large and small business, product, and service organizations, considers safety as an "Item of Special Interest to NASA" in the award criteria. |

## Internal Studies And External Reviews

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| • Does NASA pay attention to audits and reviews by external organization? What does NASA do with audit reports? | • Reviews are conducted in a manner that meets the needs of the external organization and in the best interest of NASA.<br>• NASA Policy Directive 1200.1A, Internal Management Controls and Audit Liaison and follow-up, provides specific instructions for responding to external reviews and audits. NASA personnel are required to cooperate with the GAO and OIG representatives in the audit, inspection, and assessment processes in any activity in which those representatives are engaged. All NASA offices are expected to adhere to this policy in a reasonable and timely manner. NASA personnel are required to work with auditors and other OIG and GAO representatives to provide an accurate, fair, and balanced representation on all issues being evaluated, consistent with the Inspector General Act. NASA responds to each recommendation and has a process in place to follow up and make sure corrective actions are completed. In addition, the Agency provides a formal response to all findings in the annual report of the Aerospace Safety Advisory Panel (ASAP). The ASAP is a senior advisory committee that reports to the National Aeronautics and Space Administration (NASA) and Congress. Congress established the Panel after the Apollo fire in January 1967. |

# HAZARD AND RISK MANAGEMENT

## Risk Management

### Risk Identification And Mitigation

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| • How does NASA manage risk? | • NASA policy requires program and project managers to manage risks for their projects from the earliest point in the development life cycle. NASA requires its programs and projects to have formal risk management programs that include the identification, analysis, planning (for risk handling), tracking, and control of risks. Programs and projects prioritize their identified risks according to probability, consequences, and the time frame in which risks must be handled. Management decisions on what to do about individual risks may include planning for their mitigation, decisions to accept certain risks, decisions to simply watch certain risks, and decisions to research them further when it is felt that more information is needed on which to base a decision. Program and project risks are fully identified throughout the development and operational life cycle and are periodically reviewed by the appropriate Program Management Councils at NASA's Centers or at NASA Headquarters, depending on the importance of the program or project. |
| • Does NASA require a formal risk management process on all programs and projects? | • Yes, in NASA Procedures and Guidelines document 7120.5, "Program and Project Management." |
| • What is the basic tenet of risk management? | • The basic tenet of NASA's risk management activity is we must continually identify and deal with "What can go wrong?" in our mission programs and projects. In our management of risk, "what can go wrong" is not limited to safety, but may include a variety of technical and programmatic risks including such things as cost, schedule, environmental, security, etc. |
| • Are all risks treated equally? | • No, based on our analysis of individual risks, those having higher probability or consequences and those that must be dealt with in the nearer-term are given higher priority for handling. |
| • Who can NASA employees turn to for help with the risk management process? | • At each NASA Center, the Safety and Mission Assurance organization has individuals who have been trained as trainers of NASA's Continuous Risk Management training course. These individuals train program and project teams at their Center in the application of the Continuous Risk Management methodology. Overall Agency configuration management, maintenance, and improvement of risk management methodology and training is handled by the Systems Management Office at Goddard Space Flight Center. |

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| • How are identified risks dealt with? | • Program and project managers deal with identified risk beginning with those having the highest combination of probability and consequences. Handling of risks is affected by the constraints under which program and project managers must work. Cases in which insufficient resources might compromise safety are to be raised to higher levels of management, up to and including the NASA Administrator. |
| • How does NASA control risks in contracts? | • NASA has developed specific safety and health clauses that are required on all contracts to protect and keep safe the public, astronauts and pilots, the NASA workforce, and high-value equipment and property. These clauses are contained in our NASA Federal Acquisition Regulation (FAR) supplement. For example, we have requirements to develop quality assurance surveillance plans, check high-risk areas, and tie the results to our performance-based contracting incentives. We call this contractual process Risk-Based Acquisition Management (R-BAM). |
| • Was R-BAM ever totally integrated into all of the Agency's contracts? | • R-BAM is actually not a contract requirement. Specifically, R-BAM is an acquisition requirement process to identify, track, analyze, control, document, and communicate risk at each major NASA acquisition milestone. Technical, schedule, cost, safety and security, unauthorized technology transfer; and resource risks must be addressed and quantified (e.g., high, medium, low) together with the specific actions taken to develop an acquisition approach to reduce risks. As part of this process, we have added and modified our contracts to help reduce risks and have added contractual quality surveillance plans to control risks. |
| • Since ~80% of NASA's budget goes to contractors, how does NASA control risks that may result from work done by the lowest bidder? | • NASA policy does not automatically require awarding a contract to the lowest bidder. At each acquisition milestone (e.g. requirements development, requests for proposals, source selection), NASA has established requirements and processes to identify, track, analyze, fix and communicate specific safety, technical, cost, schedule, security, and environmental risks. |

## Risk Tracking

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| • How is NASA controlling risk on Shuttle and other NASA missions? At what point are risks determined to be too high to continue? | • For each mission and at every major mission review, NASA continuously evaluates and communicates risk. We have instituted a comprehensive agency Continuous Risk Management training program and have a formal structure for risk management in our management process and policy directives for program and project management. Recently, we have also refined standards for risk definition and categorization agency-wide.<br>• On major NASA projects, you will find specific risk management plans and management tracking of as part of regular reporting within the projects and to upper management during regularly schedule Program Management Councils (PMCs) and Launch Readiness/Approval Reviews. |

## Lessons Learned

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| • Are NASA programs and projects providing complete investigative reports, corrective actions and lessons learned to support a world-class mishap prevention program? | • NASA has defined and implemented a formal process for capturing Lessons Learned.<br>• NASA uses the Lessons Learned Information System (LLIS) for entry and retrieval of data.<br>• NASA's Incident Reporting Information System (IRIS) is a comprehensive system to report, record, and follow up on mishaps and close calls. |
| • What is LLIS (Lessons Learned Information System)? | • LLIS is an on-line, automated information system designed to collect and make available for use the NASA lessons learned from over forty years in the aeronautics and space business. The LLIS enables the knowledge gained from past experience to be applied to current and future projects. Its intent is to avoid the repetition of past failures and mishaps, as well as the ability to share observations and best practices. Through this resource, NASA seeks to facilitate the early incorporation of safety, reliability, maintainability, and quality into the design of flight and ground support hardware, software, facilities, and procedures. |
| • Who can access, search, or contribute to the LLIS? | • Any NASA civil servant, on-site contractor, or off-site contractor (off-site contractors require user IDs and passwords) can access the LLIS. |
| • What do you do with new lessons? | • Lessons learned contributors first complete the submission of a lesson online. In turn, the system stores and tracks the submitted lesson through an internal multi-step approval process. Once a lesson is approved, the LLIS Curator adds it to the operational database. The LLIS also supplies the tools to support the internal review and approval process for submitted lessons. |

### Personnel Reliability Program (PRP)

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| • Does NASA have a program to assure that people who have access to the Shuttle are screened for background and suitability? | • NASA assures that all personnel (government and contractor) who have access to the Shuttle or other critical space systems are screened from a security, medical, and suitability basis. |

## Software Assurance

### Software Risk Management/Tools/Plans

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| • What risk management techniques have been applied to Software development, operations, maintenance, cost, safety, and assurance? | • NASA has an aggressive risk management approach. All projects are required to have and follow a risk management plan. Software is part of this process. |

### Software Flight Readiness/Certification

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| • Is software directly reviewed at the PAR and FRRs? | • Yes. NASA does review software safety at pre-launch reviews. |

### Software Requirements

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| • What are the assurance and safety requirements for NASA software critical systems? | • NASA has a software Safety standard and Guidebook. Software safety and Independent Verification and Validation are required for software safety critical systems.<br>• Independent Verification and Validation requirements and capabilities are defined, documented, and controlled.<br>• Independent Verification and Validation is conducted to a level appropriate to the risk and mission success criticality.<br>• Independent Verification and Validation process is controlled and monitored by appropriate level of management.<br>• Software avionics integration laboratory does system level testing of software changing before each flight. |

## Emergency/Contingency Preparedness

### Emergency Preparedness

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| • Is NASA ready to respond to a Space Shuttle contingency anywhere in the world? | • Yes, NASA is prepared to respond to a contingency anywhere in the world. |
| • Has NASA been working closely with Homeland Security (FEMA) on the Columbia accident? | • Yes, NASA has been working closely with FEMA at all levels of the response and recovery. |

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| • As the senior NASA official, do you actively participate in NASA program contingencies, exercises, and program anomalies? | • In my role as NASA Administrator, I have been actively participating in this contingency. |
| • Does NASA emergency preparedness program have a line item in the NASA budget? | • Currently emergency preparedness is funded from individual Center budgets, but has no line item in the overall NASA budget. |
| • What are in NASA's emergency planning and contingency planning documentation? | •Each NASA Center is prepared to respond to local emergencies and major national or technological disasters, both within their confines and at other NASA Centers, and to support the appropriate taskings of the Federal Response Plan. Centers are tasked to develop disaster plans based on hazard and threat vulnerability analyses as each Center develops their Emergency Preparedness Plans.<br>• Emergency/contingency plans:<br>✓ are reviewed by senior management.<br>✓ contain response times/actions<br>✓ are exercised periodically and updated as the mission and organization changes<br>✓ include hazardous operations and operations which may adversely effect the public<br>✓ address funding resources.<br>✓ are coordinated with nearby federal/state/local authorities. |
| • Who are the first responders to NASA mishaps? | • When NASA operations are at a NASA Center, medical and emergency services are onsite or nearby. Adequate emergency personnel, including first aid and CPR-trained personnel, and resources are available during all operating shifts. When contingencies occur off NASA property, the local community first responders will be first on the scene. |

**Hazardous Materials (Radiation, Toxics, Energetics)**

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| • Does NASA safety have a program to deal with the safety of handling hazardous materials and radioactive materials? | • Ionizing and non-ionizing protection program is established, thorough, and operational. Radiation emergency / contingency operations plans are in place. Covers ionizing and non-ionizing radiation.<br>• NASA rapid response personnel are trained and prepared to respond to hazardous materials contingencies.<br>• NASA's Payload Safety Review Panel reviews and must approve all hazardous materials and radiological for Shuttle flight manifesting. |

## HAZARD AND RISK ASSESSMENT

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| • Who can halt unsafe activities? | • NASA employees are empowered to halt unsafe operations if they believe the hazard will cause immediate harm. |

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| • What are workers trained to do if they observe a hazard? | • They should report it to their supervisor, or they can use the written hazard reporting system to pass on their observations or concerns to management without fear of reprisal. They may also elect to use the NASA Safety Reporting System for anonymous reporting |

**Probabilistic Risk Assessment**

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| • What is Probabilistic Risk Assessment (PRA) and who is using it? | • Probabilistic Risk Assessment (PRA) is a logical and systematic methodology to qualitatively and quantitatively assess risks and the probabilities of adverse consequences. PRA is especially useful when evaluating the risks of low-probability and high-consequence accidents involving complex systems. Over the past three decades, PRA has been used in many industries (e.g., nuclear, chemical, aerospace) to help improve safety and productivity, ensure mission success, and reduce costs without compromising safety. The Nuclear Regulatory Commission uses PRA, along with other non-PRA methods, to improve regulation in a process called "performance based, risk informed regulation." |

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| • How does a PRA model an accident sequence? | • A PRA begins by establishing the objectives of the analysis (e.g., evaluating the safety impact, economic impact, or other aspects of the design, operation or upgrade of a complex entity such as the Space Shuttle). Based on these objectives, the next step is to determine feasible undesirable types of outcomes that pertain to these objectives (e.g., people injured or killed, financial impact, etc.) Then, identifiable events that may occur, and possibly their hidden precursors, are traced in sequences of sequential events (or scenarios) that can end up in the pre-defined undesirable outcomes. The first phase of a PRA is qualitative and it utilizes logical tools such as event trees and fault trees. The logic modeling should generally include considerations of the separate or interrelated effects of equipment failure, software error, human error, as well as positive human actions that can help mitigate the progression of an accident sequence. Then, the qualitative model is quantified by calculating both the occurrence probabilities of the pre-defined undesirable outcomes and the severities of their consequences, e.g., the number of ground people that can be injured or killed at the launch site if an early launch accident of the Shuttle occurs. Because of the existence of inherent uncertainties in the data and models used in a PRA that can never be eliminated, the quantification and the results are best given in terms of probability distributions, each having shapes and spreads that are related to the degree of uncertainty. Most often, it is single-valued parameters of the result distributions, e.g. the mean value, that are quoted but the knowledge of the entire distribution is of essence in any meaningful decision process in which PRA results are used. |

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| • What are the important features of a PRA? | • A PRA is a systematic and comprehensive methodology that uses system modeling techniques (e.g., logic diagrams like event trees, fault trees, and Failure Modes and Effects Analysis (FMEA)), probabilistic, statistical and logic (Boolean) concepts and mathematics, as well as phenomenological and engineering analyses (e.g., structural, mechanical, nuclear, chemical) whose selection depends on the nature of the adverse consequences being modeled. A very important strength of PRA is that it recognizes uncertainty as being inherent, i.e., a fact of life. Uncertainties are generally things that "we know we don't know and those that we don't know that we don't know" (to quote a recent statement of Secretary Rumsfeld). There are uncertainties of many types that one deals with in performing a PRA. These are intended to account for such things as the variability of data and measured quantities that are input to PRA. There are also uncertainties due to modeling methodology, its assumptions, and lack of information or knowledge. These uncertainties are used in a PRA in the form of mathematical distributions. PRA results generally quote risk values, which are also given in terms of distributions. Risk can be expressed in terms of quantities such as the probability of adverse consequences of a given type (e.g., the probability of a catastrophic failure of the Space Shuttle). In contrast with individual failures and their associated consequences, which are observed or measured quantities, these probabilities are calculated quantities. They reflect the knowledge (and lack of) quantitative risk, the likelihood of given adverse consequence. The distributions are provided because exact values of these probabilities are never known in view of the above-mentioned inherent uncertainties. Probabilities are expressed in terms of distribution parameters, such as "mean" and "median" values and in terms high or low confidence values such as the "$5^{th}$ percentile" or the "$95^{th}$ percentile" values, respectively. For convenience, single-valued probability measures of risk, the mean or the median, that are parameters of the risk distribution (e.g., 1/250 or $4x10^{-3}$) are often quoted and are only useful to place the quantitative measure of risk in the proper perspective. The most useful single-valued quantities generated in a PRA are therefore not the mean or the median of the distribution but the relative risk contributions of the various systems and components to the overall risk value. These are the quantities that help decision makers to make decisions on enhancements in the context of cost-benefit trade-offs. |

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| • Is Probabilistic Risk Assessment (PRA) being used by NASA? | • Since the Challenger accident, PRA has been increasingly used at NASA to improve safety, performance and mission success. Over the past three years, the use of PRA at NASA has been accelerated especially for human space missions, e.g., the Space Shuttle and the International Space Station. NASA also has used PRA in missions involving nuclear payloads and is now beginning to apply it early in the product life cycle to improve design. Extensive awareness and practitioner training has been conducted at NASA Headquarters and NASA Centers. NASA currently possesses state-of-the-art computer tools to perform PRA. NASA recently developed, with the help of world-recognized experts in the field, a PRA procedures guide, and a fault tree handbook, both for aerospace applications. NASA also has a number of on-going projects aimed at advancing PRA technology. |
| • What kinds of NASA PRA efforts have been performed for the Space Shuttle? | • The important Shuttle related PRA efforts have been:<br>✓ "Independent Assessment of Shuttle Accident Scenario Probabilities for the Galileo Mission" performed in connection with the PRA for the Galileo mission, was published in 1989.<br>✓ "Probabilistic Risk Assessment of the Space Shuttle, A Study of the Potential of Losing the Vehicle During Normal Operation" published in 1995.<br>✓ A PRA effort performed in the 1997-1999 time frame by using NASA-developed QRAS (Quantitative Risk Assessment System), an integrated PRA computer program.<br>✓ Currently, the Space Shuttle Program is near completion of an effort to perform a new Space Shuttle PRA to assist in decisions about shuttle updates. This effort was started several years ago. |
| • Explain the discrepancy between the PRA-estimated probability of a catastrophic shuttle accident and the demonstrated probability of the same catastrophic accident. | • The probability of a frequent event can be reasonably well estimated from available statistics as the number of outcomes of interest divided by the total number of trials. Fore rare events such as the catastrophic failure of the Space Shuttle, this approach does not yield meaningful results. The catastrophic failure of the Space Shuttle cannot be accurately calculated by dividing the number of such accidents by the total number of flights because the total number of flights is small. Therefore, one needs to construct a mathematical model based on a methodology called probabilistic risk assessment. This model will yield a probability distribution whose mean, or average, typically describes the probability of interest. As more Shuttle flights occur and the experience database increases, the calculated distribution can be updated using statistical techniques yielding a new distribution, which generally tends to have a narrower uncertainty range than the previous distribution. |

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| • Was the potential of Foreign Object Debris impact damage considered in the existing PRA model? | • The most recent NASA Shuttle PRA effort considered the probability of Foreign Object Debris hits to the Orbiter Thermal Protection System (TPS), but it made no distinction regarding the origin of the debris. The debris could come from anywhere on the vehicle during ascent, micrometeoroid and orbital debris (MMOD) on orbit, and debris from the runway during Landing/Deceleration. |
| • How is the Shuttle PRA being used in the investigation? | • The Shuttle PRA is being used to evaluate potential scenarios that could have happened to Columbia. Each scenario consists of possible events that could have occurred and would have resulted in the loss of the Columbia. Information that is being retrieved is being used to screen out unlikely scenarios and to retain candidate scenarios. The information is also being used to update probabilities of events that could have happened. This helps to focus and prioritize the investigations. |
| • Did the Shuttle PRA include the loss of External Tank (ET) insulation as one of its scenarios? | • The shuttle PRA does include scenarios of debris impacting the orbiter that will result in loss of crew and vehicle (LOCV). This debris includes loss of insulation from the External Tank (ET) and Solid Rocket Booster (SRB), as well as from micrometeoroid impacts. A detailed mapping of the tiles is used to identify the risk contributions from tile damage and tile loss. The individual tiles and tile areas are prioritized for their risk importance with regard to LOCV. |
| • Can the Shuttle PRA evaluate the risk after observing the loss of insulation? | • The Shuttle PRA can be used to evaluate the resulting risk after observing such an incident. These types of evaluations are standard and are called precursor evaluations or conditional risk calculations. The Shuttle PRA is being used to evaluate the resulting risk implications from the observed incident of the insulation hitting the underside of the left wing. In this evaluation, the likelihood of tile damage is estimated along with the amount of possible damage sustained. The likelihood of overheating and LOCV is then also estimated. To date, this effect is not appear to be a large risk contribution by itself. |
| • Will the Shuttle PRA be modified as a result of the Columbia failure? | • A PRA should always be updated as new information is obtained. This is what makes the PRA a "living risk assessment tool." The current Shuttle PRA includes the faults and failures that have occurred to the past shuttles as well as the corrections and fixes that have been implemented. As information is obtained from the Columbia disaster, the PRA will be modified to update the assessed risks. This will help provide a tool for focusing corrections and fixes. Any performed corrections and fixes will then also be incorporated into the PRA. |

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| • How will the Shuttle PRA be used to help guide NASA in the future? | • The Shuttle PRA will be used to help guide upgrades of the Space Shuttle. It will also be used to identify how to better re-allocate resources to focus on high-risk contributors. The Shuttle PRA will show the risk benefits from proposed upgrades, which can then be weighed against their costs. It will also identify those low risk contributors from which current resources can be directed to more effectively focus on high-risk contributors. The Shuttle PRA will also be used to track the risk implications of defects and trends such as aging so that corrective measures can be taken before the risks become significant. Furthermore, the Shuttle PRA insights will serve as input to benefit designs of future generations of space transport vehicles. |
| • Is NASA planning to institute numerical risk criteria for future missions? | • One application of a PRA is to compare the numerical risk that is obtained with an acceptable risk value. Uncertainties in the PRA risk values need to be taken into account in this comparison. NASA is evaluating the use of numerical risk criteria as input to requirements for new designs and missions. NASA is also evaluating the use of numerical risk criteria to assist in the decisions about the Space Shuttle. However, this is only one type of information to be used in any decision-making process along with all relevant engineering information and expert judgment. |
| • Did the Shuttle PRA specifically model the event of the External Tank (ET) insulation hitting the Orbiter? | • The Shuttle PRA did not specifically model this event. The Shuttle PRA did model the more general event of debris from any source hitting the Orbiter. The likelihood of any debris hitting the Orbiter was determined by analyzing past debris hits on the Orbiter. There were enough hits to make reasonably good estimates of this likelihood. The hits were generally small and of little consequence. The Shuttle PRA extended these data and predicted the likelihood of more severe hits causing damage and LOCV. |
| • Did the Shuttle PRA model the event of insulation coming off the External Tank (ET)? | • The Shuttle PRA did model the event of debonding that results in insulation coming off the ET. The likelihood of different sizes of debonding occurrences was estimated along with the consequences in terms of aero heating of the tank resulting in LOCV. |
| • Does the Shuttle PRA include human errors in its risk modeling? | • The Shuttle PRA includes human error contributions. It includes the contributions from human errors that could be committed by the crew. It also includes contributions from possible human errors committed in installation, testing, maintenance, and other ground processing. Since the Shuttle involves extensive processing between missions, it is important to include these processing contributions that can be important risk contributors. |

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| • Dose the Shuttle PRA include autopilot failures and Reentry Control System (RCS) failures? | • The Shuttle PRA includes autopilot failures in its model of failures of the deceleration and landing system. The Shuttle PRA also includes failures of the Orbital Maneuvering System (OMS) and the Reentry Control System (RCS) for the reentry of the orbiter. These system models are being examined to identify candidate scenarios that are relevant to the Columbia disaster. |

## NASA Safety Reporting System (NSRS)

| | |
|---|---|
| • What is the NASA Safety Reporting System (NSRS)? | • NSRS is an anonymous, voluntary, and responsive reporting channel to notify NASA's upper management of employee concerns about hazards.<br>• Reports are guaranteed to receive prompt attention of senior personnel. |
| • When was the NSRS established? | • The NASA Administrator established the NSRS in 1987 after the Challenger accident. The NSRS has since supported all flights and has been expanded to cover all NASA operations. |
| • Who can initiate an NSRS report to the NSRS? | • Anyone can initiate a NSRS report. |
| • When is the NSRS to be used? | • The NSRS is designed to supplement local hazard reporting channels. Personnel are instructed to first report any hazard or safety concern using local established safety reporting procedures. They are to use the NSRS if –<br>✓ They have reported a hazard locally and have seen no action taken;<br>✓ They are not satisfied with the response to a reported hazard<br>✓ They fear reprisal if they were to report the hazard through local reporting channels. |
| • What may be reported to the NSRS? | • Any hazard can be reported. |
| • How is an NSRS reporter's anonymity protected? | • An NSRS contractor receives and processes reports at its office located in the Washington, DC, metropolitan area. The NSRS contractor removes a reporter's identifying information from the form (known as the identification strip) and forwards only a summary of the concerns to the NASA Headquarters Office of Safety and Mission Assurance for immediate analysis and investigation. The identification strip is mailed back to the reporter by the NSRS contractor so they know their report has been received. |
| • How are reports handled by NASA Headquarters? | • The NSRS Chair at NASA Headquarters, Office of Safety and Mission Assurance, reviews the report summary received from the NSRS Contractor and assigns action to a Technical Advisory Group (TAG) member at the appropriate NASA facility. |

| | |
|---|---|
| • How does a reporter know that their report has been addressed? | • After forwarding a summary of your report to NASA Headquarters, the NSRS contractor returns the report's identification strip to the reporter. Once the identification strip is returned, there is no direct way to inform the reporter of how the report was handled. The best way for reporters to determine if their report had any effect is to observe if there are any changes in the problems that they have reported. |
| • How many NSRS reports have been received since the inception of the program? | • Over 500 |
| • How many NSRS reports have been received regarding the Shuttle program? | • The answer to this question is being researched. |
| • Were any NSRS reports received that pertained specifically to STS-107? | • None as of Friday, February 7, 2003. |

## Problem, Failure, Near-Miss, Mishap Reporting, And Root Cause Investigation

| | |
|---|---|
| • Does NASA's policy require that problem reporting is included contingency plans? | • Yes. Problem reporting is included in operations and contingency plans. |
| • When a problem is discovered in a shuttle operation or process, how is the problem analyzed and resolved? | • NASA investigates problems to determine root cause and documents the results to prevent recurrence. |
| • What is root cause? | • The root cause is defined as one of multiple organizational factors that contributed to or created the proximate cause (immediate cause) of the accident and the subsequent undesirable outcome.<br>• Typically, each accident has multiple root causes.<br>• The proximate cause is the event(s) and conditions that occurred immediately before the undesired outcome, directly caused its occurrence, and if eliminated or modified would have prevented the undesirable outcome. |
| • Typically, how are root causes determined? | 1. A time line of events is built.<br>2. Fault trees are developed to illustrate every possible failure that could have occurred.<br>3. Noncontributing elements are eliminated from the fault trees. The resultant diagram is called an Event & Causal Factor Tree.<br>4. For each failure that remains on the tree, and is known to have existed, the question "why" will be asked.<br>5. The team will ask "why" multiple times, until the root organizational factors (such as resource management, policy, and Agency culture) are identified. |
| • Does NASA collect data on near-misses and close-calls? | • Yes. It is NASA's policy to collect data on near-misses and close-calls. The data are placed in the Incident Reporting Information System and acted upon. |

| | |
|---|---|
| • What is root cause analysis | • Root cause analysis is a structured process for identifying the basic factors, reasons, and causes for conditions that result in mishaps or close calls. |
| • Can a mishap investigation team determine criminal intent or culpability? | • No. The purpose of the NASA mishap investigation process is solely to determine the cause and develop recommendations to prevent recurrence.<br>• This purpose is completely distinct from any proceedings the agency may undertake to determine civil, criminal, or administrative culpability or liability, including those that can be used to support the need for disciplinary action. |
| • Can witness statements be viewed? | • No. Witness statements are considered to be privileged and non-releasable. However, NASA recognizes that the ultimate decision on release of witness statements may reside in the court of law. |
| • What does NASA do with the information that it learns after an accident? | • NASA takes steps to prevent recurrence by developing and implementing a corrective action plan.<br>• "Lessons learned" from the investigation and corrective actions are developed and documented to improve safety. |
| • Do NASA Center's only report and investigate major accidents | • No. It is NASA's policy to report, investigate, and document all mishaps, mission failures, and close-calls.<br>• NASA has immediate reporting requirements that allow management to react to an accident, preserve life, prevent further damage, and secure evidence so that a proper investigation can occur. |

## Product/Service Assurance Analysis And Product Protection

### Development, Manufacturing, and Operational Surveillance

| | |
|---|---|
| • How does NASA effectively assure that products are being produced to specifications? | • A quality assurance surveillance plan is developed and implemented for each program.<br>• NASA safety organizations perform and lead ongoing government surveillance.<br>• Assessments are done to identify and mitigate or eliminate hazards and build appropriate safety measures, such as failsafe features, into programs beginning early in the life cycle.<br>• Documentation is maintained by NASA safety of the surveillance, oversight, and independent assurance activities. |
| • In the past 5 years, how has the NASA surveillance process changed? Did a change in government surveillance of contractor activity cause a decrease in safety? | • NASA's surveillance of major contracts such as the Space Flight Operations Contract (SFOC) has been consistently strong over the years. When critical hardware is at stake, NASA surveillance involves significant on-site government participation and an extensive contractor performance review process. Personnel (contractor and government) work side-by-side throughout the processing activity. Our experiences have demonstrated a high level of contractor commitment when it comes to safety and quality. Furthermore, significant award and incentive fees are associated with quality and safety performance. In rare instances, where expectations have not been met, NASA has been vigorous in correcting problems and adjusting performance awards. |

### Shuttle Payload Safety

| | |
|---|---|
| • How does the NASA payload safety process ensure payloads are safe? | • All Shuttle payloads must pass a 3-phase safety review process to ensure safety, hazard identification, and hazard mitigation. The Ground Safety Review Panel reviews all payloads for safety of ground processing and integration into the Shuttle. |
| • How are payloads certified for flight? | • After completion of the 3-phase safety review process the Payload Safety Review Process (PSRP) Chairmen approves all hazard reports. The payload experimenter must also sign all hazard reports. The PSRP Chairmen also sign a Certificate of Flight Readiness attesting to the fact that the PSRP has completed its safety review and that all risks are identified. The experimenter signs a Certificate of Flight Readiness of the hardware for which the safety reviews have been conducted. |
| • Are payloads reviewed outside of the Payload Safety Review Panel? | • Yes, the Office of Safety and Mission Assurance conducts a Pre-flight Assessment Review (PAR) as preparation for participation in the Shuttle Flight Readiness Review. In this review, PAR participants independently assess all payloads and any associated hazards. |

## Verification of Hardware Safety

| | |
|---|---|
| • How does the Shuttle Program verify the safety of hardware? | • Hardware safety is verified using configuration management, maintenance, operations, and analysis activities starting with initial hardware acceptance tests and continuing through the life of the hardware.<br>• Safety requirements are an integral part of the safety process that ensures:<br>✓ Flight and critical ground systems retain their design performance, reliability, and safety throughout the life of the Space Shuttle Program.<br>✓ Implementation of closed–loop accounting for all configuration, operations, and maintenance requirements for all flights<br>✓ Operations data with regards to systems performance and reliability are monitored, analyzed, and applied to the maintenance, operations, logistics, and life cycle requirements for the systems. |
| • What activities are associated with verifying the safety of hardware? | • The safety process encompasses those activities and functions required to provide comprehensive configuration management and maintenance programs, closed–loop accounting, trend analysis, and management information.<br>• The major program functions involved are as follows:<br>✓ Configuration, operations, and maintenance requirements and implementation<br>✓ Closed–loop accounting<br>✓ Hardware/software problem resolution<br>✓ Design life validation<br>✓ Logistics requirements<br>✓ Data collection AND analyses<br>✓ Safety requirements<br>✓ Training AND certification requirements |
| • What is the role of NASA's Safety organization in verifying hardware safety? | • The safety organizations at NASA Headquarters and Centers are responsible for independent assessment of the Space Shuttle Program including the hardware safety process.<br>• To facilitate this assessment, the safety organizations are responsible for the following:<br>✓ Participate and advise program management with regard to safety requirements and implementation.<br>✓ Participate in the review and approval of all corrective actions and problem dispositions associated with safety critical hardware, software, and configuration requirements.<br>✓ Provide safety assessments on the effects of existing hazards and the possibility of new hazards.<br>✓ Perform and audit the program's safety program. |

| | |
|---|---|
| • How is safety involved in problem resolution? | • The safety organization provides technical assistance in the review of all problem dispositions associated with safety critical hardware, software, and configuration requirements including:<br>✓ Validating techniques used in the closure process.<br>✓ Supplying background/historical data from safety and quality databases.<br>✓ Assisting in the identification and acquisition of related data.<br>✓ Reviewing associated failure data.<br>✓ Evaluating the closure of problems that result in a waiver or deviation to safety requirements.<br>✓ Participating in review boards. |
| • What type of hardware problems are reported? | • The following types of problems are reported:<br>✓ Hardware and software anomalies<br>o For all critical items<br>o Unexplained or unresolved anomalies<br>o Anomalies from previous mission(s)<br>o Anomalies discovered by test or analysis<br>o Others as deemed necessary<br>✓ Material review board actions |

## Independent Activities And Assessments

### Process Verification and Program Oversight

| | |
|---|---|
| • How does NASA Headquarters (Office of Safety and Mission Assurance) ensure that NASA Centers are implementing safety policies? | • NASA Headquarters Office of Safety and Mission Assurance performs periodic Process Verification (PV) reviews of NASA Centers and Headquarters Offices (approximately once every 2 years). |
| • How does NASA Headquarters (Office of Safety and Mission Assurance) ensure that NASA Programs are implementing safety policies? | • NASA Headquarters Office of Safety and Mission Assurance assigns personnel to continuously monitor and perform oversight of the safety of program activities.<br>• NASA Center Safety organizations perform like reviews of programs, projects, and contractors. |
| • How does NASA ensure the safety of their facilities and infrastructure, including operations? | • OEP (Operations and Engineering Panel)<br>✓ Panel of facility safety personnel from across NASA review the following: facility safety, operations & maintenance, fire protection, operational safety, emergency preparedness, occupational health, environmental compliance, energy conservation, et al. |

X-Sender: prichard@mail.hq.nasa.gov
X-Mailer: QUALCOMM Windows Eudora Version 4.3.2
Date: Tue, 11 Feb 2003 07:53:50 -0500
To: Wilson Harkins <wharkins@hq.nasa.gov>
From: Pamela Richardson <prichard@hq.nasa.gov>
Subject: Re: CAC Action

Wil --

I am going to hold this action OPEN until you indicate that you have sent the info to Ashley.

Thanks!

Pam

At 04:58 PM 2/10/2003 -0500, you wrote:
> In response to a CAC action that Jim provided to me this morning I've taken several sources of data and have developed some basic talking points concerning safety and reporting procedures that are to be provided for a briefing book for the Administrator. Please look at these and make sure that the information I've assembled is correct and current. Also if you know of any other procedures that should be included let me know that as well. The due like everything else is ASAP so please take a look as soon as you can. Thanks.
>
> v/r
>
> Wil

~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~

Pamela F. Richardson
Aerospace Technology Mission Assurance Manager
Enterprise Safety and Mission Assurance Division, Code QE
Office of Safety and Mission Assurance, NASA Headquarters
300 E. Street, S. W., Washington, DC 20546
phone: 202-358-4631, fax: 202-358-2778

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"The meek can *have* the Earth. The rest of us are going to the stars." --- Robert Heinlein
"We have to learn to manage information and its flow. If we don't, it will all end up in turbulence." --- RADM Grace Hopper

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X-Authentication-Warning: spinoza.public.hq.nasa.gov: majordom set sender to owner-code-qs using -f
X-Sender: jlemke@mail.hq.nasa.gov
X-Mailer: QUALCOMM Windows Eudora Version 4.3.2
Date: Tue, 04 Feb 2003 16:49:03 -0500
To: code-qe@lists.hq.nasa.gov, code-qs@lists.hq.nasa.gov
From: jlemke <jlemke@hq.nasa.gov>
Subject: Re: Supporting Bryan on the Columbia Accident Investigation Board (CAIB)
Sender: owner-code-qs@lists.hq.nasa.gov

At 07:49 PM 2/2/2003 -0500, Pete wrote:

> Attached is a rough list we prepared today of investigative areas--for the most part these are areas in which the SMA community has some special expertise. For each area we have tentatively named an OSMA lead (and in some cases more than one person to work together). If you can think of other areas that we have not captured, and should, let me know. If we've associated you with the wrong area(s) or failed to associate you with the right area(s), let me know. We don't want to disrupt the investigation--we want to be prudent; we want to help Bryan. Think about whether and how you might be able to be helpful in these areas; then, before you take any action, write down your plan in a clear, concise manner, and send it to me--state what you might be able to do and how you would propose to do it. Then wait for a go-ahead from Jim or me. Keep in mind that we have asked the SMA directors at JSC, MSFC, KSC, LaRC, ARC, and SSC to work with us as needed, so this can be part of your plan, if appropriate.

There have been some questions about the attachment to the above email. Therefore I'd like to parse and restate Pete's direction. The specific **action** asked of us is:

1. "Think about whether and how you might be able to be helpful in these areas." If your name is next to the item, this means we are asking YOU if you think there is something to be done that would be helpful. If the answer is NO--so advise your boss.

2. If the answer is YES: "then, before you take any action, write down your plan in a clear, concise manner, and send it to me--state what you might be able to do and how you would propose to do it." Do not work the action--explain how it could be worked--including who, what, etc. (For QS--please run the plan by me before you send to Pete.)

3. "Then wait for a go-ahead from Jim or me (Pete)." (Pete--please run the QS go-aheads through me with a copy to Sylvia for tracking purposes.)

Easy as 1-2-3. (QS: can we do ours by COB Thursday? Thanks.)

johnl

John Lemke
Manager, System Safety Engineering
NASA HQ, Code QS
202-358-0567 FAX 358-3104
jlemke@hq.nasa.gov
***"Mission success stands on the foundation of our unwavering commitment to safety"***
**Administrator Sean O'Keefe January 2003**

X-Sender: eraynor@mail.hq.nasa.gov
X-Mailer: QUALCOMM Windows Eudora Version 4.3.2
Date: Tue, 04 Feb 2003 14:58:12 -0500
To: James.J.Weller@nasa.gov, tom.ambrose@mail.dfrc.nasa.gov, david.g.cleveland@nasa.gov, frank.p.mortelliti@jpl.nasa.gov, Brian.Hey@ssc.nasa.gov, Manuel.B.Dominguez@grc.nasa.gov, daniel.l.clem1@jsc.nasa.gov, l.l.rine@larc.nasa.gov, alan.clark@msfc.nasa.gov, james.t.hawkins@maf.nasa.gov, lester.a.mcgonigal.1@gsfc.nasa.gov, dhall@wstf.nasa.gov, Randall.Tilley-1@ksc.nasa.gov, dwayne.a.rye.1@gsfc.nasa.gov
From: Eric C Raynor <eraynor@hq.nasa.gov>
Subject: 1) Role of the NSRS in the Columbia Accident Investigation, and 2) Close Out of the NASA IG NSRS Audit
Cc: mhulet@mail.arc.nasa.gov, rreamy@pop300.gsfc.nasa.gov, stacey.t.nakamura1@jsc.nasa.gov, ebinns@futron.com, jlemke@hq.nasa.gov, jlloyd@hq.nasa.gov, prutledg@hq.nasa.gov, wharkins@hq.nasa.gov, whill@hq.nasa.gov, mkowales@hq.nasa.gov, wfrazier@hq.nasa.gov, prichard@hq.nasa.gov

NASA Safety Reporting System (NSRS) Technical Advisory Group (TAG) Representatives:

Although the NSRS is primarily viewed as a preventative safety reporting channel, it is also well-suited to serve as a post-accident reporting channel. In recent NASA press briefings on the loss of Columbia and her crew, several senior NASA managers have mentioned the NSRS as an available means to anonymously report any information which might be of help in the investigation into the Columbia accident. In light of these announcements, please take appropriate steps to ensure that the NSRS program remains visible and accessible to personnel at your installation. Please be sure to check your on-site displays to ensure they are well-stocked with NSRS brochures and report forms. If you need additional supplies, please let me know.

Also, please be advised that the NASA Office of the Inspector General has concluded its investigation into the NSRS process, and copies of their findings and NASA's response can be found in the enclosed PDF file attachments.

If you have any questions, please let me know.

-Eric


IG NSRS Closure Letter.pdf


Code Q NSRS Audit Closure Response.pdf

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Eric Raynor, Program Analyst
Code QS - Safety and Assurance Requirements Division
Office of Safety and Mission Assurance
NASA Headquarters, Washington, DC 20546

Phone: 202-358-4738
Fax: 202-358-3104
Email: eraynor@hq.nasa.gov

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NSRS: http://www.hq.nasa.gov/nsrs
NSRS Intranet: http://nsrs-pbma-kms.intranets.com
LLIS: http://llis.nasa.gov
LLIS Intranet: http://llsc-pbma-kms.intranets.com
GIDEP: http://www.gidep.org

GIDEP Intranet: http://gidep-pbma-kms.intranets.com
SOLAR: https://solar.msfc.nasa.gov
Code Q Homepage: http://www.hq.nasa.gov/office/codeq

National Aeronautics and
Space Administration
**Headquarters**
Washington, DC 20546-0001

JAN 14 2003

Reply to Attn of: W

TO: Q/Associate Administrator for Safety and Mission Assurance
H/Associate Administrator for Procurement

FROM: W/Assistant Inspector General for Audits

SUBJECT: Continued Need for the NASA Safety Reporting System (NSRS)
Assignment Number A-02-006-01

We are providing information from our audit survey for your use in determining whether to exercise a June 2003 option to extend the contract for the NSRS.

Our work indicates that the NSRS may duplicate other safety reporting systems and that its use and effectiveness have been affected because NASA did not adequately promote the program or provide guidance for consistent administration, and employees lacked awareness of the system's benefits.

Agency emphasis on reporting safety concerns at the lowest level has resulted in the development of Center-specific, anonymous reporting systems, such as the close call reporting system. Employees are also able to anonymously report safety hazards through the Ombudsman Program and the Occupational Safety and Health Administration's Complaint Process. Employees are reporting more concerns through the local systems than through the NSRS. For example, from May 1999 to March 2002, Johnson Space Center generated 47 percent of the NSRS reports. Johnson's close call reports for fiscal year 2002 averaged about 70 a month, whereas Agencywide, the NSRS averaged only 1 to 2 reports a month. Moreover, from May 1999 to March 2002, 50 (83 percent) of the 60 NSRS–reported concerns were previously reported through other reporting mechanisms. Management considered only 7 (12 percent) of those 60 reports to be immediate concerns.

In the event that NASA exercises the contract option for the NSRS program, the Office of Safety and Mission Assurance should take steps to improve program use and effectiveness by addressing the following conditions:

- the NSRS contractor had not promoted the NSRS program at NASA Centers or contractor sites;

- the NASA Office of Safety and Mission Assurance did not provide guidance to Center personnel to ensure consistent administration (for example, investigative report approvals, file administration, etc.) of the NSRS; and

- Agency employees believed the NSRS was limited to the Space Shuttle program or to Headquarters-related safety concerns.

We found that NASA and the NSRS contractor effectively notified the appropriate NASA Centers of safety concerns reported, and that the Centers' personnel appropriately addressed, dispositioned, and resolved those concerns.

We are terminating work on this assignment. Please provide us a written response identifying your decision on the contract option. We appreciate the courtesies and cooperation provided to the auditors during the survey. If you have questions, or would like to discuss this matter further, please contact Ms. Sandy Massey, Program Director, Safety and Technology Audits, at (321) 867-4057, or Ms. Kathleen Kirby, Auditor-in-Charge, at (281) 483-2733.

Alan J. Lamoreaux

cc:
ADT/Associate Deputy Administrator
AB/Associate Deputy Administrator for Institutions and Asset Management
HK/Director, Contract Management Division
QS/Director, Safety and Risk Management Division
JM/Director, Management Assessment Division
GSFC/100/Director, Goddard Space Flight Center

National Aeronautics and
Space Administration
**Headquarters**
Washington, DC 20546-0001

January 31, 2003

Reply to Attn of: QS

TO: W/Assistant Inspector General for Audits

FROM: Q/Associate Administrator for Safety and Mission Assurance

SUBJECT: NASA Safety Reporting System (IG Audit A-02-006-01)

Thank you for sharing the findings of your recent audit of the NASA Safety Reporting System (NSRS). The intent of the NSRS has always been to augment existing local reporting channels and ensure that, regardless of local civil servant or contractor safety reporting procedures, the NASA workforce will always have an additional and consistent means to anonymously report concerns about hazards. Accordingly, we plan to renew our upcoming option on the NSRS contract.

We are also reinvigorating Agencywide NSRS awareness and accommodating your suggestions by:

- Working with our support contractor to update and distribute NSRS awareness posters, brochures, and reporting forms. The updated materials will emphasize the program's broad applicability to all NASA activities—not just the Shuttle program.
- Considering requiring NSRS displays (poster with information brochures and reporting forms) in all NASA facilities where the workforce presence would require the display of an OSHA poster under 29 CFR 1903.2.
- Ensuring that all personnel involved in NSRS report processing have the guidance they need by revalidating our NSRS operating guides and technical manuals.

If you have any further questions or comments about our current or future plans for the NSRS program, please let me know.

Bryan O'Connor

cc:
ADI/Mr. Jennings
ADT/Dr. Greenfield
H/Mr. Luedtke
HK/Mr. Thompson
JM/Mr. Werner
Q/Mr. Lloyd

To: Mark Kowaleski <mkowales@hq.nasa.gov>
From: J Steven Newman <snewman@hq.nasa.gov>
Subject: Re: External Tank:Critical Processes / CFC Replacements
Cc:
Bcc:
Attached:

Mark: In-Work
R/Steve

At 11:34 AM 2/4/2003 -0500, you wrote:
Steve,

Are you pulling any data that you may have on this?

Thanks,

Mark

At 08:27 AM 2/4/2003 -0500, you wrote:
Bryan:

Several notes and suggestions based on work experience as Chief Environmental Engineer in OSF leading the replacement of Ozone Depleting Substances (1990-1994)

**1. External Tank Blowing Agents**
Main ET acreage blowing agent CFC-11 replaced with HCFC-141B. Other blowing agents for close out items at Cape also replaced - I am researching / finding old files. Requalification of new materials and processes was obviously a critical concern. At some point the Materials branch of the Fault Tree will want to closely examine this issue.

**2. External Tank Precision Cleaning Agents**
Even more critical in both the ET and especially the SRM is surface preparation (precision cleaning) of metal pre-bonding. Any separation of material from a metallic substrate raises questions related to PROCESS branch of Fault Tree. In this case it is a process and a material question. The SSP, prior to the phase out used copiou amounts of Freon 113 (CFC-113) and a material called 1,1,1, TCA for precision cleaning prior to bonding operations. Need to investigate and identify the current surface preparation process for Orbiter bi-pod attach struts.

**3. Method of Evaluation in Moving From the What to the Why**

It may be useful to take a process failure perspective. For example if we identify the triggering event as foam breaking off the Orbiter bipod and hitting the Orbiter we will want to pursue:

**A. Potential Process Failures:**

Bipod Foam Material Integrity
Bipod Foam Application/surface prep process
Bipod foam application process human error, etc.

**B. In-Line Critical Process Controls**

Critical importance to identify in-place control processes for each crit sub-process involved. Why did control fail?

**C. External (independent assessment) controls over critical process**

What external independent control processes were operative?
DCMA?, NASA QA?, USA second set of eyes?

**D. Resource/Requirements Balance enabling the critical process**

Critical process integrity, water pressure, staffing, time factors, etc.

**4. Independent reviews of USAGO**

Please note that we have three recent (in last four years) independent assesment reports on various aspects of SSP/USAGO processes, including a workfor5ce survey of 72 wrench turners. . These may become important later.

Continuing to wotk the Highly secure Work Group capability. Meanwhile I will dig into the files and try to work up more ET / foam / precision cleaning material immediately.

R/Steve

To: Pete Rutledge <prutledge1@comcast.net>
From: J Steven Newman <snewman@hq.nasa.gov>
Subject: Re: Question/issue for Bryan
Cc:
Bcc:
Attached:

Done / drafted last night / Sent a minute ago

At 08:28 PM 2/3/2003 -0500, you wrote:

> Steve,
>
> Please write down your idea about the changes to the ET foam spray application process (was it a change to the solvent for environmental reasons?) and send it to Pam as issue that Bryan might wish to pursue. Don't wait to find your old files.
>
> Thanks,
>
> Pete

X-Info: ODIN / NASA Glenn Research Center
X-Sender: rqwess@popserve.grc.nasa.gov
X-Mailer: QUALCOMM Windows Eudora Version 5.1.1
Date: Fri, 21 Feb 2003 13:33:46 -0500
To: J Steven Newman <snewman@hq.nasa.gov>
From: Vernon W Wessel <Vernon.W.Wessel@nasa.gov>
Subject: Re: Fwd: Re: NASA/SMA IA Reviews of SSP Ground Ops / Exec Summaries

Thank You Steve

At 01:17 PM 2/21/2003 -0500, you wrote:
Bill et al.

FYI/Steve

X-Sender: boconnor@mail.hq.nasa.gov
X-Mailer: QUALCOMM Windows Eudora Version 4.3.2
Date: Fri, 21 Feb 2003 13:09:12 -0500
To: J Steven Newman <snewman@hq.nasa.gov>
From: boconnor <boconnor@hq.nasa.gov>
Subject: Re: NASA/SMA IA Reviews of SSP Ground Ops / Exec Summaries
Cc: jlloyd@hq.nasa.gov, prutledg@hq.nasa.gov, swander@hq.nasa.gov, jcastell@hq.nasa.gov, mkowales@hq.nasa.gov, pamela.richardson@hq.nasa.gov

Steve,
Thanks...the Board has expressed interest in this subject.
By the way, the PBMA team is doing a great job.
Best,

At 10:08 AM 2/21/2003 -0500, J Steven Newman wrote:
Bryan:

As the investigation unfolds questions will undoubtedly continue to be raised concerning Shuttle processing work-force capability, critical process management, and management in general.

The attached document (provided for a quick overview) contains excerpts / verbatim executive summaries from three independent assessment (reviews) of the Space Shuttle Program Ground Operations at Kennedy Space Center conducted between the summer of 1998 and the spring of 2001 by the NASA/HQ OSMA.

The complete reports are available (in hardcopy or electronically) as you may require.

Regards/Steve

O'C

Bryan O'Connor
Associate Administrator
Office of Safety and Mission Assurance

Vernon W.(Bill) Wessel
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John H. Glenn Research Center
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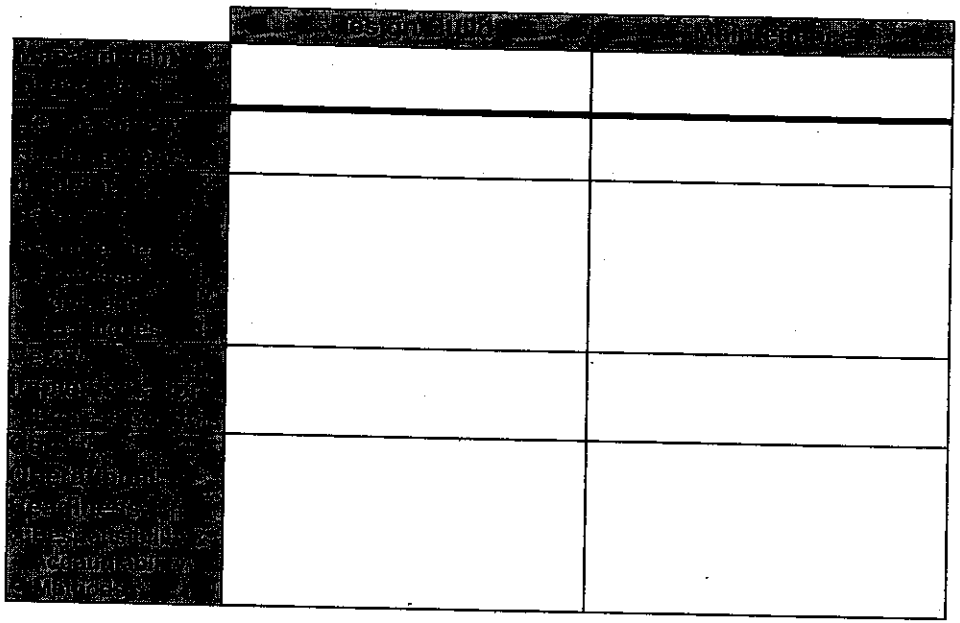
Mission Success Starts With Safety

**jlloyd@hq.nasa.gov, prutledg@hq.nasa.gov, 04:49 PM 2/5/2003 -0500, 13 Pages of Questions by SM**

To: jlloyd@hq.nasa.gov, prutledg@hq.nasa.gov
From: J Steven Newman <snewman@hq.nasa.gov>
Subject: 13 Pages of Questions by SMA Area Used in NNBE
Cc:
Bcc:
Attached: C:\Documents and Settings\snewman\My Documents\Data\Data\Attach\NNBE Matrix_Rev11.doc;

Jim/Pete
Hope this helps
R/Steve

# NASA / NAVY Benchmarking Exchange (NNBE) Questionnaire Template



| | | |
|---|---|---|
| Management and Organization | 1. Organizational Structure<br>2. Technical Authority<br>3. Resource Management<br>4. Procurement<br>5. Downsizing | 1. Organizational Structure<br>2. Technical Authority<br>3. Resource Management<br>4. Downsizing |
| [illegible] | 6. Governing Documents<br>7. Overarching Requirements<br>8. Overarching Philosophy<br>9. Requirements Ownership | 5. Governing Documents<br>6. Overarching Requirements<br>7. Overarching Philosophy<br>8. Requirements Ownership |
| [illegible] | 10. Concept Development<br>11. System Engineering*<br>12. Design Verification Processes<br>13. Risk Management<br>14. Software Assurance<br>15. People (Management)<br>16. People (Training)<br>17. Work Management<br>18. Material Control<br>19. Advanced Technology Insertion/Modernization<br>20. Design Tools and Techniques<br>21. Overarching Questions | 9. System Engineering*<br>10. Risk Management<br>11. Software Assurance<br>12. People (Management)<br>13. People (Training)<br>14. Work Management<br>15. Material Control<br>16. Advanced Technology Insertion/Modernization<br>17. Life-cycle Extension<br>18. Maintenance/Refit/ Overhaul Tools and Techniques |
| [illegible] | 22. Quality Assurance **<br>23. Work Review Processes<br>24. Supply Chain Management<br>25. Reviews (Requirements, Design, Build)<br>26. Independent Analysis/Assessment Control Boards<br>27. Control Boards<br>28. Functional Audits | 19. 0Overarching Questions<br>20. Quality Assurance **<br>21. Work Review Processes<br>22. Supply Chain Management<br>23. Reviews (Requirements, Design, Build)<br>24. Independent Analysis/Assessment Control Boards<br>25. Control Boards<br>26. Functional Audits |
| [illegible] | 29. Certification Audits<br>30. Certification Review Processes | 27. Certification Audits<br>28. Certification Review Processes |

* Include Configuration Management in System Engineering

** Include Surveillance, Inspection and Lessons Learned in Quality Assurance

(KB) = Kathy BoylesQuestions

(N) = Safety-of-Flight Questions

Note: Best Practices apply to all rows of the matrix.

## 1. Organizational Structure

- Where does safety and mission assurance responsibility lie? Provide an "Assurance Process Map" showing the primary organizations responsible for implementing safety, risk management and mission assurance requirements, including key assurance control boards, independent assessment organizations, assurance support contractors, and reporting relationships.
- (KB) What are the various levels of management and how are responsibilities allocated (departments / projects / IPTs / working groups)? Describe use of the Integrated Product Team (IPT) approach for performance of work and the role of safety and mission assurance professionals within an IPT.
- (KB) Do you have separate Departments for QA and for CM, or are those functions within the various departments?
- (KB) What is the department orientation in respect to design/build? Does a single project affect several departments, or is the entire project designed / developed under a single department?
- (KB) What types of incentive programs related to safety do you have?
- (N) Define the infrastructure support used to maintain certification for the life of the system. Please describe your organization responsible for the certification of safety-critical systems.
- Describe how safety and mission assurance gets funded.

## 2. Technical Authority

- What is the line of authority and ownership for life-cycle design/build/test safety and mission assurance requirements?
- (KB) How do you decide what future science and technology research to pursue/fund?
- Describe the performance assurance management systems employed by the Technical Authority.

## 3. Resource Management

- What are the principal acquisition instruments (e.g., cost-plus-fixed-fee contracts) used for new build operations? Are incentives/disincentives built into the contract (e.g., penalties for late delivery)?
- Is performance-based contracting used where the government specifies what needs to be built, and the contractor determines how it needs to be built?
- When the government specifies the "how", who becomes responsible for performance (Navy/NASA or contractor)? What has the past experience been?
- Are contracts competed or are they sole source?
- Are payments tied to milestone events?
- (N) What selection criteria are invoked when picking an in-house or sub-contractor software developer specifically for safety-critical systems?
- (KB) Do you budget for future science and technology research in the areas of safety

## 1. Organizational Structure

- Where does safety and mission assurance responsibility lie? Provide a program management wiring diagram showing the organizational elements accountable for enabling the safety and mission assurance infrastructure as well as the organizations responsible for implementing safety and mission assurance requirements
- (KB) What is the department orientation in respect to maintenance?
- (KB) Does a single project affect several departments, or is the entire project designed/developed under a single department?
- (KB) What are the various levels of management and how are responsibilities allocated (departments/projects/IPTs/working groups)?
- (KB) What types of incentive programs related to safety do you have?
- (KB) Do you have separate Departments for QA and for CM, or are those functions within the various departments?
- Provide an "Assurance Process Map" showing the primary organizations responsible for implementing safety, risk management and mission assurance requirements, including key assurance control boards, independent assessment organizations, assurance support contractors, and reporting relationships.
- Describe how safety and mission assurance gets funded?
- Describe use of the Integrated Product Team (IPT) approach for performance of work and the role of safety and mission assurance professionals within the IPT.

## 2. Technical Authority

- What is the line of authority and ownership for maintenance/overhaul/refit safety and mission assurance requirements?
- Describe the performance assurance management systems employed by the Technical Authority.

## 3. Resource Management

- What are the principal acquisition instruments (e.g., cost-plus-fixed-fee contracts) used for maintenance/supportability?
- Are payments tied to milestone events?
- Are incentives/disincentives built into the contract (e.g., penalties for late delivery)?
- Are contracts competed or are they sole source?
- How are contractor safety and mission assurance requirements implemented within the acquisition process?
- How are "build or buy" decisions conducted for maintenance/supportability?

## 4. Downsizing

and human factors?

- (KB) Do you leverage new technology ideas/research from other services/industry? If so, what collection/solicitation methods do you use?
- How are contractor safety and mission assurance requirements implemented within the acquisition process?
- How are "build or buy" decisions conducted (e.g., select COTS hardware)? What restrictions, tests, analyses or life-cycle considerations are invoked when considering the use of Commercial Off-the-Shelf hardware or software in a safety-critical system design?
- Are contracts/work to be performed considered R&D (technology development) state-of-the-art with significant development risks?

## 4. Procurement

- Are appropriate specific quality / safety requirements for systems, subsystems or components specified in all procurements?

## 5. Downsizing

- How has the Navy maintained new build capability in the face of budget constraints?
- Was there a morale issue with the design engineers (Navy or contractors) resulting from the budget/schedule constraints? If so, how was it dealt with?
- How did the Navy/private yards maintain contractor supplier teams necessary for new build operations?
- Was a premium paid to maintain the supplier chain?
- How did the Navy identify and implement facility/plant closures?
- What issues were faced during facility closures, what actions were taken, and what were the outcomes?
- Did the Navy/contractors/private yards take action to protect/find employment for displaced design engineers?
- How did the Navy/contractors/private yards maintain a core engineering and design competency during periods of restricted budgets for new build operations?
- What actions did the Navy take to assure new build/design safety in light of appropriations reductions?
- What lessons learned relating to new build operations and the production downturn did the Navy identify?
- How was security (protection of design information) maintained at the private yards during the production downturn (e.g., issues with layoffs/disgruntled workers)?

## 6. Governing Documents

- Describe the governing safety, mission assurance and risk management policies and procedures documents applicable to life-cycle vehicle/platform safety, reliability, availability, quality, operability, and maintainability.

- Was there an issue with the morale of workers (Navy or contractors) resulting from the reduction in production in the early 1990's? If so, how was it dealt with?
- How did the Navy/private yards maintain critical skills necessary for implementing the production and operations requirements?
- How did the Navy/private yards maintain contractor supplier teams necessary for production and logistics support (Spares)?
- Was a premium paid to maintain the supplier chain?
- How did the Navy identify and implement facility/plant closures?
- What issues were faced during facility closures, what actions were taken, and what were the outcomes?
- Did the Navy/private yards take action to protect/find employment for displaced maintenance workers?
- How did the Navy/private yards maintain high levels of safety during the production downturn?
- How did the Navy maintain the necessary sustaining engineering level of support for maintenance operations during the production downturn?
- Did the Navy encounter problems with pre-planned product improvements (upgrades) during the downturn in production?
- Did the Navy encounter any operational problems (e.g., obsolescence) during the downturn? If so, what were the problems, and how were they handled?
- What actions did the Navy take to assure safety in light of appropriations reductions?
- What lessons learned relating to maintenance operations and the production downturn did the Navy identify?
- How was security (protection of hardware) maintained at the private yards during the production downturn (e.g., issues with layoffs/disgruntled workers)?

## 5. Governing Documents

- Describe the governing safety, mission assurance and risk management policies and procedures documents applicable to life-cycle vehicle/platform safety, reliability,

| | |
|---|---|
| • Describe the extent to which requirements can be tailored and the process for documenting the rationale and accepting risks associated with waiving requirements.<br><br>7. Overarching Requirements<br>• What are the assurance requirements?<br>• Who was involved in developing the requirements?<br>• Where are they contained?<br>• Who is responsible for implementation?<br>• What are the resources necessary to accomplish assurance activities?<br>• Do assurance activities include government independent validation of contractor analyses?<br><br>8. Overarching Philosophy<br>• How are safety requirements assured during new build operations?<br>• Are functional and certification audits conducted for new builds?<br>• If so, who conducts the audits and how are they conducted?<br>• What are the safety relationships within the organization, and where are the responsibilities for safety documented?<br>• (N) What do you define as safety-critical systems and components? How do you define the boundary between non-safety critical and safety critical? What are the criteria?<br><br>9. Requirements Ownership<br>• Who is responsible for developing the safety requirements for new build operations and is this a lifecycle responsibility?<br>• What is the responsibility of the Program Manager relative to safety?<br>• (KB) How does a new safety requirement get recognized? What is the process for suggesting and getting approval for the new requirement? | availability, quality, operability, and maintainability.<br>• Describe the extent to which requirements can be tailored and the process for documenting the rationale and accepting risks associated with waiving requirements.<br><br>6. Overarching Requirements<br>• What are the assurance requirements?<br>• Who was involved in developing the requirements?<br>• Where are they contained?<br>• (N)What is the process used to control maintenance performed on a safety-critical system and how they are different from your standard processes?<br>• (N) What are your special maintenance and re-test procedures and documentation for safety-critical systems?<br>• (N) What are your periodic maintenance or testing requirements for fiber optic cable?<br>• Who is responsible for implementation?<br>• What are the resources necessary to accomplish assurance activities?<br>• Do assurance activities include government independent validation of contractor analyses?<br><br>7. Overarching Philosophy<br>• What are the differences between functional and certification audits?<br>• (N) What is the maintenance concept for the related equipment and what supply support mechanisms are in place to support the maintenance concept (e.g. Organizational, Intermediate and Depot level)?<br>• Who conducts these audits and how are they conducted?<br>• How is safety compliance achieved when maintenance occurs during operations (analogous to Space Shuttle anomaly investigations)?<br>• How is Unrestricted Operations (URO) certification maintained during operations, i.e., who is responsible for SUBSAFE – the ship Captain, Type Command, Fleet Command)?<br>• What are the safety relationships within the organization, and where are the responsibilities for safety documented?<br><br>8. Requirements Ownership<br>• Who is responsible for developing the safety requirements for maintenance operations and is this a lifecycle responsibility? |
| 10. Concept Development<br>• What organization is responsible for concept development?<br>• How is safety and mission assurance incorporated into the concept development phase for new build?<br>• Is the safety and mission assurance function actively represented on the concept development team?<br>• What is the process for new concept development? | 9. System Engineering*<br>• Who is responsible for system engineering (Navy/NASA or contractor)?<br>• Describe the approach to system engineering in maintenance/supportability?<br>• Is the organization's system engineering process formally documented?<br>• Is safety and mission assurance considered an integral part of the maintenance process? |

- At what level of maturity is a new concept applied to into a new requirement?

## 11. System Engineering*

- (N) Please provide an overview of your design development and certification process for safety. (If available, please provide a functional flow chart.)
- (N) What specific requirements are imposed on design and development of automatic flight control algorithms that ensure safe and reliable operation under all environmental and mission conditions?
- (N) What requirements are placed on the vehicle dynamic simulation model used in the development of the safety-of-flight control system and operator trainers? How do these requirements vary over the range of possible operating conditions (e.g., normal and casualty conditions)?
- (N) What operational guidance is provided to operators governing the operation of a safety-critical system outside its specified design limits.
- Is a life-cycle system engineering approach used?
- Who is responsible for system engineering (Navy/NASA or contractor)?
- (N) How do you select design and configuration management tools used for the design and development of a safety-critical system?
- Describe the approach to system engineering in the new build process.
- (N) What are the parameters or characteristics of the safety-critical system that require certification?
- Is the organization's system engineering process formally documented?
- Is safety and mission assurance considered an integral part of the system engineering design/development process?
- (N) What are the specific certification criteria for the design and development of automatic flight control algorithms?
- (N) What are the specific certification criteria for the vehicle dynamic simulation model?
- (N) How are the design and development of automatic flight control algorithms integrated with the design and/or selection of flight control hardware (such as actuator, sensors, etc.)?
- (N)How in the design of automatic flight control algorithms are failure conditions and other off design conditions considered?
- (N) In the development and validation of the vehicle dynamic simulation, when, how and what criteria do you use to decide if the following are used:
  1. computational predictions (only)
  2. computational predictions verified by scale-model testing
  3. wind tunnel (captive model testing)
  4. free-running model
  5. empirical or semi-empirical models based predominantly on scale-model testing
  6. prototype (i.e., large/full-scale) testing to support simulation model development/validation

## 12. Design Verification Processes

- (KB) If you have an IV&V process, is the verification at the requirements level, or a

## 10. Risk Management

- Is a formal risk management process used, or is another process (less formal) applicable to maintenance/supportability?
- (N) What process do you use to determine the range and depth of readily available safety-critical system repair parts?
- Where is the organization's risk management process formally documented?
- Do contractors (e.g., GDEB) utilize a formal risk management process?
- Where is the contractor's risk management process formally documented?
- How are tradeoffs conducted between performance, cost, schedule, and safety?
- What specific tools and techniques are used in the risk management process (e.g., Probabilistic Risk Assessment (PRA), Failure Modes and Effects Analysis (FEMA), Fault/Event Tree Analysis (FTA))?

## 11. Software Assurance

- What is the process for software assurance and safety during maintenance/supportability?
- Is the organization adhering to the Capability Maturity Model (CMM) process? What level is required?
- How are software safety and quality assurance requirements implemented for maintenance/supportability?
- Are software safety and quality assurance requirements documented?
- Is developed software independently validated and verified (IV&V)?
- Who performs the IV&V?

## 12. People (Management)

- How are issues relating to Human Factors/Performance identified and implemented the maintenance/refit/overhaul process?
- How do the Navy and private yards recruit/maintain design engineering talent in order to maintain a new build capability?

## 13. People (Training)

- How do the Navy and private yards ensure proper training, qualification, and certification for design engineering personnel involved in new build operations?
- (N) Is there any special awareness or other unique training or qualifications needed for the maintainer of a safety-critical system needs beyond that provided in other training courses, technical manuals, flight manuals etc. to ensure safe system and reliable system operation ?
- Do the Navy and private yards specifically hire qualified design engineers, or do they train their engineers in-house?
- Is there a mentoring program in place for design engineering knowledge capture/transfer

functional level?

- (KB) Is functional testing for safety and human factors accomplished in a laboratory environment if it is possible to do so?
- (N) Is safety-critical software (such as the automatic flight control software) required to undergo various levels of testing (such as unit level testing, closed-loop testing, and man-in-the-loop testing) for certification? Please describe the particular levels of testing.
- (N)Is the baseline flight control system required to undergo full-scale vehicle testing? Please define the scope of full-scale testing.
- (N) What process do you use to validate and approve the vehicle dynamic simulation model?
- (N) What level of testing and/or analyses is performed to verify the adequacy of safety-critical systems to ensure they will operate safely?
- (N) What are the processes and criteria used to evaluate if the safety-critical system is safe to operate, resulting in the certification of the baseline system?
- (N) What are the re-certification processes and criteria used to evaluate if a safety-critical system is safe to operate following system modifications or maintenance?
- (N) What are the inspection, maintenance and testing requirements to support continuation of system certification?
- Describe the verification philosophy and practice concerning the use of the following approaches for vehicle design verification:
  - analysis,
  - test,
  - similarity,
  - simulation and modeling, and
  - heritage.

## 13. Risk Management

- Is a formal risk management process used, or is another process (less formal) applicable to design/new build?
- Where is the organization's risk management process formally documented?
- Do contractors (e.g., GDEB) utilize a formal risk management process?
- Where is the contractor's risk management process formally documented?
- Do Navy/NASA acquisition instruments require a formal risk management process?
- (N) What additions are made to the system/software safety analysis process because of the safety-critical systems?
- (N) What changes are made in system, hardware and software development standards and requirements because the safety critical nature of the system?
- How are tradeoffs conducted between performance, cost, schedule, and safety?
- (N)To what extent do you identify, qualify, and control safety-critical components?
- (N) What special construction and test requirements are imposed on safety-critical systems?
- What specific tools and techniques are used in the risk management process (e.g., Probabilistic Risk Assessment (PRA), Failure Modes and Effects Analysis (FEMA), Fault/Event Tree Analysis (FTA))?

## 14. Software Assurance

(i.e., succession planning)?

- Are there certification (and re-certification) requirements for engineering personnel?

## 14. Work Management

- Describe the processes employed to manage work quality necessary to ensure a safe and reliable product. Address the following areas (as a minimum).
  - Configuration management,
  - Work Authorization Processes (Technical Authority to proceed with work),
  - Materials: material certification process,
  - Processes: critical process certification,
  - Critical Process Baseline Metrics,
  - Metrics for process capability,
  - Metrics for process stability,
  - Identification of process controls,
  - Work Planning and Scheduling,
  - Paper: work instructions,
  - People: training, skill certification and experience requirements necessary to perform specific tasks,
  - Critical Tooling or Fixture certification,
  - Metrology and calibration services,
  - Production verification: testing / Non Destructive Evaluation , and
  - Work Acceptance (Paper "buy-off" ).
- What are the policies and processes for implementing work management (e.g., critical process management) to ensure safety and mission assurance?
- (KB) What type of metrics do you collect and use during a product life-cycle to decide affectiveness of your processes?
- Who is responsible for performing maintenance planning and developing work packages and work instructions?
- (KB) Is your maintenance work kept separate from design work? If so, how are builds coordinated in your organization. A build could consist of both design changes and maintenance changes.
- (KB) Do you have working groups and Integrated Product Teams to make decisions on whether or not to implement design / maintenance changes? Do you have a Configuration Control Board?
- How is work controlled (configuration management)?

## 15. Material Control

- What are the policies and processes for material control?
- Are there particular requirements related to materials for reentry of a submarine back into the operational fleet?

## 16. Advanced Technology Insertion / Modernization

- What is the process for software assurance and safety?
- (N) Assuming you have frequent system and software design reviews, how does the system being safety-critical impact the frequency, breath, and formality of customer and user participation in the review?
- What development / test / verification processes and standards are being applied?
- Is the organization adhering to the Capability Maturity Model (CMM) process? What level is required?
- How are software safety and quality assurance requirements implemented in the new build process?
- Does a software assurance plan exist?
- Are software safety and quality assurance requirements documented?
- Is developed software independently validated and verified (IV&V)?
- What software surveillance / verification reviews are planned?

## 15. People (Management):

- How are issues relating to Human Factors/Performance identified and implemented in the new build process?
- How do the Navy and private yards recruit/maintain design engineering talent in order to maintain a new build capability?
- (KB) Does NASA have a Science Advisor? This person would be constantly keeping track of new technologies in the area of safety and human factors which would be applicable to the space program, as well as other new technologies.

## 16. People (Training)

- How do the Navy and private yards ensure proper training, qualification, and certification for design engineering personnel involved in new build operations?
- (N) What process do you use to train and certify crews to operate and maintain your system and supporting equipment (e.g., Flight Simulator, Computer Based Emulation, Interactive Electronic Technical Manual (IETM) interface with Training Products)?
- (N) Do you have training software embedded in tactical/operational systems and equipment? If so how do you ensure this software does not adversely affect safe operations of safety-critical systems?
- (N) How does NASA certify/train personnel that will be signing for certification? Is there a specific list of qualifications and is there some letter or certificate that documents that they are certified?
- Do the Navy and private yards specifically hire qualified design engineers, or do they train their engineers in-house?
- Is there a mentoring program in place for design engineering knowledge capture/transfer (i.e., succession planning)?
- Are there certification (and re-certification) requirements for engineering personnel?

## 17. Work Management

- Describe the processes employed to manage work quality necessary to ensure a safe and

- What is the process for determining what gets upgraded?
- How does the approval process for insertion of advanced technology work?
- (KB) How does new technology enter the life cycle process?
- (KB) How are QA and CM kept in the loop for new technology insertion?
- (KB) What criteria is used to determine when to replace technology which has become outdated - such as OS software?
- Does the Navy have a group of people dedicated to advanced technology (analogous to NASA's Advanced Products for Shuttle)?
- How is insertion of advanced technology implemented?
- How is the safety of advanced technology verified?
- What is the process involved for technology insertion in the modernization process?

## 17. Life-cycle Extension

- How are environmental influences controlled in the modernization process?
- (KB) How does your use of modular design make the process of life-cycle extension easier? In what ways do you use it?
- (KB) What hardware/software design features have you found useful to make life-cycle extension easier?

## 18. Maintenance/Refit/Overhaul Tools and Techniques

- Describe the use of the following analytical tools in process control, process error prevention methods:
  - Process Systems Safety Hazard Analysis,
  - Process Failure Modes and Effects Analysis,
  - Process Fail -Safing (Poke-yoke),
  - Six-Sigma Process Control, and
  - Key Process Characteristic (KPC) management.

reliable product. Address the following areas (as a minimum).
- Configuration management,
- Work Authorization Processes (Technical Authority to proceed with work),
- Materials: material certification process,
- Processes: critical process certification,
- Critical Process Baseline Metrics,
- Metrics for process capability,
- Metrics for process stability,
- Identification of process controls,
- Work Planning and Scheduling,
- Paper: work instructions,
- People: training, skill certification and experience requirements necessary to perform specific tasks,
- Critical Tooling or Fixture certification,
- Metrology and calibration services,
- Production verification: testing / Non Destructive Evaluation, and
- Work Acceptance (Paper "buy-off").

- (KB) What type of metrics do you collect and use during a product life-cycle to decide affectiveness of your processes?
- (N)_What fabrication and process controls are used for production, installation and servicing of safety- critical systems?
- What are the policies and processes for implementing work management (e.g., critical process management) to ensure safety and mission assurance?
- Who is responsible for performing maintenance planning and developing work packages and work instructions?
- How is work controlled (configuration management)?

## 18. Material Control

- What are the policies and processes for material control?
- Are there particular requirements related to materials for entry of a submarine into the operational fleet?

## 19. Advanced Technology Insertion / Modernization

- What is the process for determining what gets upgraded?
- How does the approval process for insertion of advanced technology work?
- (KB) How does new technology enter the life cycle process?
- (KB) How are QA and CM kept in the loop for new technology insertion?
- (KB) What criteria is used to determine when to replace technology which has become outdated - such as OS software?
- Does the Navy have a group of people dedicated to advanced technology (analogous to NASA's Advanced Products for Shuttle)?
- How is insertion of advanced technology implemented?

| | |
|---|---|
| • How is the safety of advanced technology verified?<br>• What is the process involved for technology insertion in the modernization process?<br><br>20. Design Tools and Techniques<br><br>• Describe the use of the following analytical tools in the Design / Build / Test / Operate process:<br>- Systems Safety Hazard Analysis,<br>- FMEA-CIL Analysis,<br>- Fault Tree Analysis,<br>- Risk Management Analysis,<br>- Six-Sigma Design (for manufacturability), and<br>- Key Product Characteristic (KPC) Management. | |
| 21. Overarching Questions<br><br>*Safety assurance is achieved in part by implementation and verification, through inspection and test, of safety and reliability design features.*<br>• Who conducts oversight analysis, inspection, and test verifications to ensure vehicle compliance with the intended design?<br>• What are the independent verification requirements?<br>• Where are they contained?<br>• Who is responsible for independent verification?<br>• What are the resources to accomplish verification activities?<br>• How is independent verification accomplished?<br>• How is independent validation of contractor analyses accomplished?<br><br>22. Quality Assurance<br><br>• Is a formal quality management system used for design/build?<br>• Is the Navy/NASA ISO 9001 compliant?<br>• Are ISO 9001 certified contractors used for design/build?<br>• How are supply chain management, closed loop corrective action, and defect prevention addressed throughout the design/build lifecycle?<br>• How is control of deviations implemented in the design/build process?<br>• How is work reviewed (inspection, surveillance, acceptance)?<br>• What is the role of the Defense Contract Management Administration (DCMA) or DCMA delegate (e.g., Supervisor of Shipbuilding) in quality assurance?<br>• How and where are lessons learned captured?<br>• How are lessons learned disseminated and implemented through out the community?<br>• How are previous design heritage and lessons learned applied to a new build or design process? | 19 Overarching Questions<br><br>*Safety assurance is achieved in part by implementation and verification, through inspection and test, of safety and reliability design features.*<br>• Who conducts oversight analysis, inspection, and test verifications to ensure vehicle compliance with the intended design?<br>• What are the independent verification requirements?<br>• Where are they contained?<br>• Who is responsible for independent verification?<br>• What are the resources to accomplish verification activities?<br>• How is independent verification accomplished?<br>• How is independent validation of contractor analyses accomplished?<br><br>20. Quality Assurance<br><br>• Is a formal quality management system used for maintenance operations?<br>• Is the Navy/NASA ISO 9001 compliant?<br>• Are ISO 9001 certified contractors used for maintenance operations?<br>• How are supply chain management, closed loop corrective action, and defect prevention addressed throughout the maintenance life cycle?<br>• How is control of deviations implemented in the maintenance process?<br>• How is work reviewed (inspection, surveillance, acceptance)?<br>• What is the role of the Defense Contract Management Administration (DCMA) or DCMA delegate (e.g., Supervisor of Shipbuilding) in quality assurance?<br>• How and where are lessons learned captured?<br>• How are lessons learned disseminated and implemented through out the community?<br><br>21 Work Review Processes: |

## 23. Work Review Processes:

- Who is responsible for the continuing surveillance and Independent Assessments activities?
- What continuous surveillance mechanisms (IAs, insight, oversight, etc.) are planned / required?
- What safety and quality performance metrics are being used and how are they reported?
- Describe the work verification processes and responsibilities employed in vehicle build, assembly and integration:
  - Contractor Inspection/Surveillance,
  - DCMC Inspection/Surveillance,
  - Government Mandatory Inspection Points,
  - Electronic data sharing, and
  - Acceptance Authority.

## 24. Supply Chain Management

*Safety and mission assurance is also dependent upon flow down of performance assurance requirements consistent with system level requirements to subcontractors and implementation of vendor controls.*

- Discuss and describe the flow-down and management of critical safety requirement implementation within the vehicle (submarine or space vehicle) supply chain (vendors, contractors and sub-contractors).

## 25. Reviews (Requirements, Design, Build)

- Describe formal review processes employed to ensure product quality and safety. Examples might include:
  - Preliminary Requirements Review
  - Preliminary Design Review
  - Critical Design Review
  - Design Certification Review
  - Build Acceptance Reviews
  - Major Component Integration Reviews
  - Test Readiness Reviews
  - Operational Readiness Reviews

## 26. Independent Analysis/Assessment

- Is there a requirement to perform independent analysis or assessment to ensure safety and mission assurance?
- How is it decided to when to do independent analysis or assessment?
- Describe the use of independent engineering analysis in the design and verification of critical system elements.
- Describe use of outside Independent Assessment "Gray Beard" review teams at various critical milestones and events in the project life-cycle.

- Who is responsible for the continuing surveillance and Independent Assessments activities?
- What continuous surveillance mechanisms (IAs, insight, oversight, etc.) are planned / required?
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  - Contractor Inspection/Surveillance,
  - DCMC Inspection/Surveillance,
  - Government Mandatory Inspection Points,
  - Electronic data sharing, and
  - Acceptance Authority.

## 22. Supply Chain Management

*Safety and mission assurance is also dependent upon flow down of performance assurance requirements consistent with system level requirements to subcontractors and implementation of vendor controls.*

- Discuss and describe the flow-down and management of critical safety requirement implementation within the vehicle (submarine or space vehicle) supply chain (vendors, contractors and sub-contractors).

## 23. Reviews (Maintenance / Refit / Overhaul)

- Describe formal review processes employed to ensure product quality and safety. Examples might include:
  - Tool or fixture certification review
  - Critical process certification review
  - Critical Operations Reviews (e.g., major element lift or move)
  - Build (or work completion) Acceptance Review
  - Major Component Integration Reviews
  - Test Readiness Reviews
  - Operational Readiness Reviews

## • 24 Independent Analysis/Assessment

- Is there a requirement to perform independent analysis or assessment to ensure safety and mission assurance?
- How is it decided to when to do independent analysis or assessment?
- Describe the use of independent engineering analysis in the design and verification of critical system elements.
- Describe use of outside Independent Assessment "Gray Beard" review teams at various critical milestones and events in the project life-cycle.

| | |
|---|---|
| **27. Control Boards**<br>• Identify roles and responsibilities of major program boards.<br>• (N) What configuration management procedures are utilized after the safety-critical system is baselined or deployed?<br>• (N) How are changes to safety-critical systems or components uniquely addressed in the configuration management process?<br>• (N) How do you ensure design or operational changes are reviewed from a safety of flight critical perspective for impacts to control algorithms, vehicle dynamics or trainers?<br>• (N) What unique procedures are used to control the pedigree of vendor supplied hardware and software products; e.g., the identification, verification, storage and maintenance of the products?<br>• (N) What determines where, when and how a configuration change to a safety-critical system is installed?<br>• (N) How do you verify the performance of safety-critical components provided by the manufacturer with the same part numbers which may have been manufactured with different discrete parts?<br>• (N) What special documentation is required to be retained with all safety-critical spare parts (both new and repaired parts)? What's done with that documentation after the part is issued and used?<br>• (N) How do you maintain certification of multiple baselines of a safety-critical system?<br>• Identify individuals who chair these boards. Examples include:<br>- Configuration Control Board<br>- Engineering Review Board<br>- Material Review Board<br>- Risk Management Boards<br>**28. Functional Audits**<br>• Describe the processes for verifying that key organizational elements are fully capable to perform safety critical work.<br>• Describe the means by which management gains confidence in an organization's ability to implement safety requirements throughout the design/product/program lifecycle?<br>• Discuss how the audit function determines whether or not an organization has the necessary resources to successfully perform necessary tasks? Address issues of organizational stability, staffing levels, experience, skill-mix, training, and organizational structure. | **25. Control Boards**<br>• Identify roles and responsibilities of major program boards.<br>• Identify individuals who chair these boards. Examples include:<br>- Configuration Control Board<br>- Engineering Review Board<br>- Material Review Board<br>- Risk Management Boards<br>**26. Functional Audits**<br>• Describe the processes for verifying that key organizational elements are fully capable to perform safety critical work. Describe the means by which management gains confidence in an organization's ability to implement safety requirements throughout the design/product/program lifecycle?<br>• Discuss how the audit function determines whether or not an organization has the necessary resources to successfully perform necessary tasks? Address issues of organizational stability, staffing levels, experience, skill-mix, training, and organizational structure. |
| **29. Certification Audits**<br>• What are the processes for verifying the safety requirements throughout the design/product/program lifecycle? | **27. Certification Audits**<br>• What are the processes for verifying the safety requirements during maintenance operations? |

# WORKING DOCUMENT

| | | |
|---|---|---|
| | 30. Certification Review Processes<br><br>*The final operational readiness certification process for a submarine or a space vehicle is based on senior management attaining: knowledge, understanding, visibility, and objective quality evidence to support decision making.*<br>• Describe the processes that enabled/provided management knowledge (K) of life-cycle critical processes stability, capability, and control.<br>• Describe the processes that enabled/provided management understanding (U) of safety/mission critical issues and their resolution.<br>• Describe the processes that enabled/provided visibility (V) into risks, risk decisions, and risk acceptance rationale.<br>• Describe how Objective Quality Evidence (OQE) was gathered and documented demonstrating that safety, risk management, and assurance processes were fully implemented throughout the program/project life-cycle. Examples of OQE acquisition may include: surveillance, document and data review, observation of work and tests in process, and attendance at meetings.<br>• (N) What oversight or audits are used to verify the quality and technical adequacy of safety-of-flight control systems during design, production, installation, operation, maintenance, and certification of the system?<br>• Describe the hierarchy of formal reviews conducted for key system elements that precede the ultimate certification review.<br>• Describe the formal process for documenting final approval decisions such as signature logs, video taping, and formal polling.<br>• Describe the "jury" composition that is polled for the final "go" decision, and the ability of a single dissenting vote to hold the decision (that is - is a consensus required). | 28. Certification Review Processes<br><br>*The final operational readiness certification process for a submarine or a space vehicle is based on senior management attaining: knowledge, understanding, visibility, and objective quality evidence.*<br>• Describe the processes that enabled/provided management knowledge (K) of life-cycle critical processes stability, capability, and control.<br>• Describe the processes that enabled/provided management understanding (U) of safety/mission critical issues and their resolution.<br>• Describe the processes that enabled/provided visibility (V) into risks, risk decisions, and risk acceptance rationale.<br>• Describe how Objective Quality Evidence (OQE) was gathered and documented demonstrating that safety, risk management, and assurance processes were fully implemented throughout the program/project life-cycle. Examples of OQE acquisition may include: surveillance, document and data review, observation of work and tests in process, and attendance at meetings.<br>• Describe the hierarchy of formal reviews conducted for key system elements that precede the ultimate certification review.<br>• Describe the formal process for documenting final approval decisions such as signature logs, video taping, and formal polling.<br>• Describe the "jury" composition that is polled for the final "go" decision, and the ability of a single dissenting vote to hold the decision (i.e., is a consensus required). |

* Include Configuration Management in System Engineering

Note: Best Practices apply to all rows of the matrix.

To: jcastell@hq.nasa.gov
From: J Steven Newman <snewman@hq.nasa.gov>
Subject: Fwd: External Tank:Critical Processes / CFC Replacements
Cc:
Bcc:
Attached:

Date: Tue, 04 Feb 2003 08:27:14 -0500
To: boconnor@hq.nasa.gov
From: J Steven Newman <snewman@hq.nasa.gov>
Subject: External Tank:Critical Processes / CFC Replacements
Cc: jlloyd@hq.nasa.gov, prutledg@hq.nasa.gov, mkowales@hq.nasa.gov, wbihner@mail.hq.nasa.gov, prichardson@hq.nasa.gov

Bryan:

Several notes and suggestions based on work experience as Chief Environmental Engineer in OSF leading the replacement of Ozone Depleting Substances (1990-1994)

**1. External Tank Blowing Agents**
Main ET acreage blowing agent CFC-11 replaced with HCFC-141B. Other blowing agents for close out items at Cape also replaced - I am researching / finding old files. Requalification of new materials and processes was obviously a critical concern. At some point the Materials branch of the Fault Tree will want to closely examine this issue.

**2. External Tank Precision Cleaning Agents**
Even more critical in both the ET and especially the SRM is surface preparation (precision cleaning) of metal pre-bonding. Any separation of material from a metallic substrate raises questions related to PROCESS branch of Fault Tree. In this case it is a process and a material question. The SSP, prior to the phase out used copiou amounts of Freon 113 (CFC-113) and a material called 1,1,1, TCA for precision cleaning prior to bonding operations. Need to investigate and identify the current surface preparation process for Orbiter bi-pod attach struts.

**3. Method of Evaluation in Moving From the What to the Why**

It may be useful to take a process failure perspective. For example if we identify the triggering event as foam breaking off the Orbiter bipod and hitting the Orbiter we will want to pursue:

**A. Potential Process Failures:**

Bipod Foam Material Integrity
Bipod Foam Application/surface prep process
Bipod foam application process human error, etc.

**B. In-Line Critical Process Controls**

Critical importance to identify in-place control processes for each crit sub-process involved. Why did control fail?

**C. External (independent assessment) controls over critical process**

What external independent control processes were operative?
DCMA?, NASA QA?, USA second set of eyes?

**D. Resource/Requirements Balance enabling the critical process**

Critical process integrity, water pressure, staffing, time factors, etc.

**4. Independent reviews of USAGO**

Please note that we have three recent (in last four years) independent assesment reports on various aspects of SSP/USAGO processes, including a workfor5ce survey of 72 wrench turners. . These may become important later.

Continuing to wotk the Highly secure Work Group capability. Meanwhile I will dig into the files and try to work up more ET / foam / precision cleaning material immediately.

R/Steve

To: henry.hartt@baesystems.com
From: J Steven Newman <snewman@hq.nasa.gov>
Subject: Fwd: Re: External Tank:Critical Processes / CFC Replacements
Cc:
Bcc:
Attached:

X-Sender: boconnor@mail.hq.nasa.gov
X-Mailer: QUALCOMM Windows Eudora Version 4.3.2
Date: Fri, 07 Feb 2003 07:34:54 -0500
To: J Steven Newman <snewman@hq.nasa.gov>
From: boconnor <boconnor@hq.nasa.gov>
Subject: Re: External Tank:Critical Processes / CFC Replacements

Steve,
Thanks, much appreciated.
Best,

At 08:27 AM 2/4/2003 -0500, you wrote:
Bryan:

Several notes and suggestions based on work experience as Chief Environmental Engineer in OSF leading the replacement of Ozone Depleting Substances (1990-1994)

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R/Steve

O'C

Bryan O'Connor
Associate Administrator
Office of Safety and Mission Assurance

From: "Murphree-Grafton, Gail" <Gail.Murphree-Grafton@msfc.nasa.gov>
To: "'snewman@hq.nasa.gov'" <snewman@hq.nasa.gov>
Subject: questions
Date: Fri, 7 Feb 2003 12:41:51 -0600
X-Mailer: Internet Mail Service (5.5.2653.19)

Hi Steve,
As it turns out, different cleaning processes can be used on different areas. One would probably have to have the floor papers to determine what was used on that particular area. I'm sure that info would be available through the data request system. I will forward to you any further info I receive that you might be able to use.

I suggest that you look in your library or otherwise try to get a copy of the External Tank System Definition Handbook. The one I have is for the Super Light Weight Tank. The document specifics are as follows:

Space Shuttle External Tank
System Definition Handbook SLWT

Volume I: Configuration and Operation
Volume II: Layout Drawings
LMC-ET-SE61-1
DR SE61 WBS 3.6.6
NAS8-36200
Dec. 1997

Best regards,
Gail

Gail Murphree Grafton ~ United Space Alliance
Lead, Shuttle Environmental Assessment
Shuttle Propulsion Systems Integration Office
Marshall Space Flight Center ~ Huntsville AL
256-544-2483 ~ gail.murphree-grafton@msfc.nasa.gov

**Murphree-Grafton, Gail, 12:47 PM 2/7/2003 -0600, presentation**

From: "Murphree-Grafton, Gail" <Gail.Murphree-Grafton@msfc.nasa.gov>
To: "'snewman@hq.nasa.gov'" <snewman@hq.nasa.gov>
Subject: presentation
Date: Fri, 7 Feb 2003 12:47:04 -0600
X-Mailer: Internet Mail Service (5.5.2653.19)

this may be helpful:

http://www.eng.tulane.edu/Tef/Slides/Williams_Slides.ppt

warning -- it is a large file and may take a little while to download.

Gail Murphree Grafton ~ United Space Alliance
Lead, Shuttle Environmental Assessment
Shuttle Propulsion Systems Integration Office
Marshall Space Flight Center ~ Huntsville AL
256-544-2483 ~ gail.murphree-grafton@msfc.nasa.gov

X-Sender: wfrazier@mail.hq.nasa.gov
X-Mailer: QUALCOMM Windows Eudora Version 4.3.2
Date: Mon, 10 Feb 2003 17:23:20 -0500
To: yolanda.y.marshall1@jsc.nasa.gov, Oscar.Toledo-1@ksc.nasa.gov,
Amanda.Goodson@msfc.nasa.gov, Michael.Smiles@ssc.nasa.gov,
mark.d.erminger@nasa.gov, GarriH@kscems.ksc.nasa.gov,
Alex.Adams@msfc.nasa.gov, roy.w.glanville@nasa.gov
From: "Wayne R. Frazier" <wfrazier@hq.nasa.gov>
Subject: Code Q Response to Congessional Q's Code Q Response to
Congessional Q's
Cc: BOConnor@hq.nasa.gov, jlloyd@hq.nasa.gov, jlemke@hq.nasa.gov,
prutledg@hq.nasa.gov

All,

Here is what we have assembled so far using mostly data in Appendices in vol II to the Roger's commission report and input from the SMA community. Thanks to all. This answered the mail and we (mostly legal) contrasted this with how the CAIB is organized to weave a story that the CAIB is set up similarly to how Rogers' finally evolved. We will further refine it as we get more actions from legal for the hearings. Info only, no need to respond.

(my paraphrase of the Roger's Commission timeline) (all 1986 dates.)
In the first few days of the Roger's Commission hearings, (Feb10, 13 and 14th) the commission began to learn of the disturbing development about the launch decision and that many of the NASA folks briefing the commission and providing analysis were involved in that decision. On Feb 15th Chairman Rogers issued a statement reflecting a change in direction of the commission activities from one of over sight to one of direct investigation and analysis. The commission divided itself into 4 panels:

Development and Production team chaired by Joe Sutter.

Pre-launch activities team led by David Acheson

Mission Planning and Operations team chaired by Dr. Sally Ride.

Accident Analysis team chaired by MG Don Kutyna. (with a sub team consisting of recovery led by Col Ed O'Connor)

On Feb 18th Chairman Rodgers described this new approach to Congress.

The new panels began their work on Feb 18th or 19th, going to MSFC, KSC and Thiokol to redirect efforts.

NASA was directed to reorganize its interface with the Rogers commission to match up to these new Commission teams. On Mar 11, William Graham, Acting Administrator of NASA created the Data and Design Analysis Task Force (DDATF) chaired by Rear Adm Richard Truly, which was established to directly interface with the Rogers Commission's new teams and to replace the NASA interim Mishap

Investigation Board. Some folks have data that shows Feb 5, 1986 for this rechartering, but this seems too early, but Mar 11 seems more logical)

The NASA teams were as follows:

NASA Dev and Production team

T.J. Lee MSFC Chair
C.E. McCullough JSC
Robert Stewart JSC
Ms. S.G. Henderson MSFC
D. L. Riley JSC
+ senior members from level III project offices

NASA Prelaunch team

Tom Utsman KSC Chair
Col R. Bourne USAF
J. Harrington KSC
W. Rock KSC
M. Jones KSC
S. Hawley JSC

NASA Mission Planning and Operations

Tommy Hollowy JSC Chair
Harold Draughon JSC

others???

NASA Accident Analysis

J. R. Thompson MSFC Chair
John W. Thomas MSFC
+ level III project team leads

SSME/G.D. Hopson
SRM/R.J. Schwinghamer
SRB/G.F. McDonough
Systems Working Group/H.N. Scofield
IUS/TDRS Systems Working Group/R.W. Hughes
Recovery Support/C.R. McIntosh

Photo Analyses Support/G.F. McDonough
Orbiter & GFE/G.A. Coultas (JSC)
Orbiter/Payload Interface/L.E. Bell (JSC)
TDRS/SPARTAN/R.C. Bauman (GSFC)
+Morton Thiokol

These teams provided data and analysis to the Rogers commission who performed their own independent analysis using their own and outside experts. Each NASA team provided a final written report which is in vol II of the final Roger's commission reports.

thanks, more to come.

Wayne

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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"*

</x-html>

From: "MARSHALL, YOLANDA Y. (JSC-NA) (NASA)" <yolanda.y.marshall@nasa.gov>
To: "'James Lloyd'" <jlloyd@hq.nasa.gov>, smadir@hq.nasa.gov
Cc: jlemke <jlemke@hq.nasa.gov>,
"HARRIS, WILLIAM J. (JSC-MA) (NASA)"
<william.j.harris@nasa.gov>
Subject: RE: questions for the hearing
Date: Mon, 10 Feb 2003 14:10:22 -0600
X-Mailer: Internet Mail Service (5.5.2653.19)

Jim,

8. Did NASA workforce reductions on the Space Shuttle program (from 3,000 to 1,800 full time employee reductions between FY 1995-99) heighten risks to the Space Shuttle fleet? (Code M/Readdy with support from Q/O'Connor)
Code Q Action Leads - John Lemke and Dale Moore (jlemke@hq.nasa.gov)

Answer: It is believed that reductions were made methodically and carefully.

11. Did budget cuts to the Space Shuttle program over the last 10 years contribute to systemic safety problems with the Space Shuttle? (Code M/Readdy with support from Code Q/O'Connor)
Code Q Action Leads - John Lemke and Dale Moore (jlemke@hq.nasa.gov)

Answer: (a) Increased attention to safety as demonstrated by the center safety metrics, participation in the OSHA voluntary protection program, etc. (b) Trend reports reflect a decrease in in-flight anomalies. (c) Implemented upgrades program to address safety concerns.

16. Were any safety procedures short-changed in the Space Shuttle program as a result of budget cuts over the last 10 years? (Code M/Readdy with Q/O'Connor support)
Code Q Action Leads - Pete Rutledge (prutledg@hq.nasa.gov)

Answer: Reference to answers in number 8 and 11

-----Original Message-----
From: James Lloyd [mailto:jlloyd@hq.nasa.gov]
Sent: Monday, February 10, 2003 11:14 AM
To: smadir@hq.nasa.gov
Cc: jlemke
Subject: Fwd: questions for the hearing

**MARSHALL, YOLANDA Y. (JSC-NA) (NASA), 02:10 PM 2/10/2003 -0600, RE: questions for the hearing**

Dear SMA Director,

As Paul Harvey would say, "Here is the rest of the story."

These constitute the essence of those things that will be discussed in a joint Congressional hearing to be held on Wednesday at 9:30 a.m. EST. The witnesses will include Sean O'Keefe, Fred Gregory and Bill Readdy. It is thought that this will be broadcast live via NASA TV.

I'll talk to all shortly.

>X-Sender: bcherry@mail.hq.nasa.gov
>X-Mailer: QUALCOMM Windows Eudora Version 4.3.2
>Date: Mon, 10 Feb 2003 08:44:50 -0500
>To: Jim.Lloyd@hq.nasa.gov
>From: Barbara Cherry <bcherry@hq.nasa.gov>
>Subject: questions for the hearing
>
>Jim
>
>The attached are the questions which are in work in preparation for the
>hearing. Don't know if you received the actual copy yet, but wanted to
>provide you with the completed list. Most are assigned to Code M,
>however, there are a few questions which have a Q lead or support with M.
>
>Barbara
>
>

X-Sender: wfrazier@mail.hq.nasa.gov
X-Mailer: QUALCOMM Windows Eudora Version 4.3.2
Date: Mon, 10 Feb 2003 14:22:26 -0500
To: "GLANVILLE, ROY W. (JSC-NC) (NASA)" <roy.w.glanville@nasa.gov>
From: "Wayne R. Frazier" <wfrazier@hq.nasa.gov>
Subject: Re: Here's the DDATF Membership You Asked For
Cc: jlloyd@hq.nasa.gov, jlemke@hq.nasa.gov, jmullin@hq.nasa.gov,
prutledg@hq.nasa.gov

Thanks, some old familiar names.

W

At 12:35 PM 2/10/2003 -0600, you wrote:
Wayne,

Here's the DDATF Membership Info you requested.

Roy Glanville
MQ/Space Shuttle SR&QA

From:

http://history.nasa.gov/rogersrep/v3appn.htm#n3

The following personnel are appointed to memberships on the 51-L Data and Design Analysis Task Force.

Rear Admiral Richard H. Truly, Chairman (Associate Administrator for Space Flight)
Mr. James R. Thompson, Vice Chairman (NASA Headquarters)
Mr. Robert Crippen (NASA Astronaut, JSC)
Col. Nathan Lindsay (Commander, AF Eastern Space and Missile Center)
Dr. Joseph Kerwin (Director, Space and Life Sciences, JSC)
Dr. Walter Williams (Special Assistant to the NASA Administrator)
Mr. Thomas Lee (Deputy Director, MSFC)
Mr. Clay McCullough (Manager, Support Equipment and Logistics Office, JSC)
Mr. Thomas Utsman (Deputy Director, KSC)
Col. Robert Bourne (Director, AF Space Shuttle Operations, VAFB)
Mr. Alton Jones (Director of Flight Assurance. FSFC)
Mr. John Thomas (Manager, Spacelab Program Office, MSFC)
Mr. Tommy Holloway (Chief, Flight Director Office, JSC)
Mr. Harold Draughon (Manager, Mission Integration Office, JSC)
Mr. Edward F. Parry (Chief Counsel, KSC) will serve as Legal Counsel to the Task Force. Mr. Jay F. Honeycutt (Deputy Manager of Operations and

Integration Office, JSC) will serve as Task Force Staff Officer in NASA Headquarters.

~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~

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"

From: "Goodson, Amanda" <Amanda.H.Goodson@nasa.gov>
To: "'Wayne R. Frazier'" <wfrazier@hq.nasa.gov>,
yolanda.y.marshall1@jsc.nasa.gov, Oscar.Toledo-1@ksc.nasa.gov,
Amanda.Goodson@msfc.nasa.gov, Michael.Smiles@ssc.nasa.gov,
mark.d.erminger@nasa.gov, GarriH@kscems.ksc.nasa.gov,
Alex.Adams@msfc.nasa.gov, smadir@hq.nasa.gov
Cc: jmannix@hq.nasa.gov, James Lloyd <jlloyd@hq.nasa.gov>,
prutledg@hq.nasa.gov, jlemke <jlemke@hq.nasa.gov>,
mgstamatelatos <mstamate@mail.hq.nasa.gov>, dmoore@hq.nasa.gov
Subject: RE: Hearing Questions (Code Q's been assigned a role in 5 out of 24) URGENT
Date: Mon, 10 Feb 2003 13:21:52 -0600
X-Mailer: Internet Mail Service (5.5.2653.19)

## I have the following response, to your questions:

**1. NASAs Challenger data and design analysis task force was established at the same time as the Rogers Commission. The Rogers Commission started in early February 1986. This would put February 5, 1986, as the most likely start of Admiral Truly's Task Force.**

**2. Agree with the list of names for the NASA Development and Production Team.**

**3. Agree with this list of names for the NASA Prelaunch Team.**

**4. Have not found NASA Mission Planning and Operations Membership. Harold Draughon was the deputy to Tommy Hallaway on the team. We did find an organizational chart with lower level responsibilities but no actual names assigned. If requested, I can fax the flow chart to you.**

**5. The following are additional members of the Accident Analysis Team:**
**SSME/G.D. Hopson**
**SRM/R.J. Schwinghamer**
**SRB/G.F. McDonough**
**Systems Working Group/H.N. Scofield**
**IUS/TDRS Systems Working Group/R.W. Hughes**
**Recovery Support/C.R. McIntosh**
**Photo Analyses Support/G.F. McDonough**
**Orbiter & GFEG.A. Coultas (JSC)**
**Orbiter/Payload Interface/L.E. Bell (JSC)**
**TDRS/SPARTAN/R.C. Bauman (GSFC)**

-----Original Message-----
**From:** Wayne R. Frazier [mailto:wfrazier@hq.nasa.gov]
**Sent:** Monday, February 10, 2003 9:45 AM

**To:** yolanda.y.marshall1@jsc.nasa.gov; Oscar.Toledo-1@ksc.nasa.gov; Amanda.Goodson@msfc.nasa.gov; Michael.Smiles@ssc.nasa.gov; mark.d.erminger@nasa.gov; GarriH@kscems.ksc.nasa.gov; Alex.Adams@msfc.nasa.gov; smadir@hq.nasa.gov
**Cc:** jmannix@hq.nasa.gov; James Lloyd; prutledg@hq.nasa.gov; jlemke; mgstamatelatos; dmoore@hq.nasa.gov
**Subject:** Re: Hearing Questions (Code Q's been assigned a role in 5 out of 24) URGENT

Here is what I have been able to piece together so far!! Need input before noon.
As near as I can read, these teams were part of the Data and Design Analysis Task Force (DDATF) chaired by Rear Adm Richard Truly, which was established by the Acting NASA Administrator William Graham. I have conflicting dates for their charter, either Feb 5, 1986 or Mar 11 1986 depending on which appendix you reference of the Rogers Commission. Any help would be appreciated.

NASA Dev and Production team

T.J. Lee MSFC Chair
C.E. McCullough JSC
Robert Stewart JSC
Ms. S.G. Henderson MSFC
D. L. Riley JSC
+ senior members from level III project offices

NASA Prelaunch team

Tom Utsman KSC Chair
Col R. Bourne USAF
J. Harrington KSC
W. Rock KSC
M. Jones KSC
S. Hawley JSC

NASA Mission Planning and Operations

Tommy Hollowy JSC Chair
Harold Draughon JSC ???

others???

NASA Accident Analysis

J. R. Thompson MSFC Chair
John W. Thomas MSFC

R. J. Schwinghamer MSFC
+ level III booster
+Morton Thiokol

URGENT

This is a follow-up to Jim's message of 8:49 this am, regarding the question number 24 "What is the difference between the approach of the Rogers Commission and the approach laid out by NASA?" which I have been assigned the action, Bob Stevens Deputy General Counsel has asked that we try to show the level of direct NASA support to the Roger's commission. In that regard, I have determined that NASA organized into 4 teams to support the 4 Roger's Commission investigation teams, each of which was chaired by a commission member.

Team 1 was led by Jack Lee from MSFC and supported the Dev and Production team chaired by Joe Sutter.

Team 2 was led by Tom Utsman from KSC and supported the Pre-launch team led by David Acheson

Team 3 was led by Tommy Holloway from JSC who supported the Mission Planning and Ops team chaired by Dr. Sally Ride.

Team 4 was led by J.R. Thompson from MSFC who supported the Accident Analysis team chaired by MG Don Kutyna.

Before noon, today, I need to populate these teams with the NASA members. Please go into your memory banks or talk to folks who were around then and provide the names to me.

Again, we need this by noon to the General Counsel. thanks, Call me or email me.

Wayne

I need topopulate with names how the Rogers commission was organized from the NASA support staff. We need you to go into your memory if available At 08:49 AM 2/10/2003 -0500, James Lloyd wrote:
Dear Human Space Flight SMA Director,

We have been handed 5 questions for which we at Code Q will play a role in answering. For one question we are assigned the lead role and the remaining 4 we are playing a support role to either Code M or Code G. I have only sent the 5 out of the entire batch of 24

to you for your information.

By noon we have to have an answer assembled for our External Affairs Office. What I would like from you are short bulletized thoughts on what you think should be addressed in the NASA answer. Although you may have thoughts on question 4 and question 24 (and these are certainly welcome), I would really like you to concentrate on the three questions numbered 8, 11, and 16. Provide your feedback in the next two hours directly by email to the named action lead with a copy to me.

We will talk at 1 PM EST this afternoon at the normally established teleconference.

Jim

~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
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"*

</BODY></HTML>

</x-html>

Reply-To: jlloyd@mail.hq.nasa.gov
X-Originating-IP: 68.100.166.170
X-URL: http://mail2web.com/
From: "jlloyd@mail.hq.nasa.gov" <jlloyd@mail.hq.nasa.gov>
To: prutledg@hq.nasa.gov, jlemke@hq.nasa.gov
Cc: boconnor@hq.nasa.gov
Subject: Information Flow with Bryan
Date: Sat, 15 Feb 2003 11:19:41 -0500
X-OriginalArrivalTime: 15 Feb 2003 16:19:41.0608 (UTC) FILETIME=[0B539280:01C2D50E]
X-MIME-Autoconverted: from quoted-printable to 8bit by bolg.public.hq.nasa.gov id LAA06146

Pete and John,

I spoke with Bryan Saturday morning just as he may have been arriving at MAF and he wants us to honor the protocol set by the CAIB -- requests will be processed thru the Task Force and if something is needed from Code Q explicitly it will most likely either be direct from Task Force (maybe thru Joe Ripma) or perhaps thru HQ via the HCAT.

We will continue to process information of interest that we feel the Program may not have by sending it to the HCAT.

We will also continue to process the probing questions we have been collecting to Bryan. Bryan will raise with the CAIB and it may come back to NASA thru the Task Force.

I will be off site (weather permitting) with the Administrator and SR. Staff on Tuesday. Please communicate these groundrules to SMA Directors during teleconference on Tuesday at 1 PM.

Jim

---

X-Authentication-Warning: spinoza.public.hq.nasa.gov: majordom set sender to owner-code-q using -f
X-Sender: prichard@mail.hq.nasa.gov
X-Mailer: QUALCOMM Windows Eudora Version 4.3.2
Date: Thu, 13 Feb 2003 10:24:47 -0500
To: code-q@lists.hq.nasa.gov
From: Pamela Richardson <prichard@hq.nasa.gov>
Subject: POC at LaRC for Columbia information requests
Sender: owner-code-q@lists.hq.nasa.gov

Recently, a friend of mine from LaRC called to offer information to our Columbia efforts on research done at LaRC in the early 80s regarding on-orbit tile repair for Shuttle. With Pete's help, I was able to obtain the information and it has been provided to Mark Kowaleski and Ron Moyer. Anyone is welcome to make a copy, it is in my office.

Through the effort, I did, in my thank yous to the people at LaRC, ask if LaRC has defined a POC for Columbia information requests. Del Freeman has named Mark P. Saunders, Deputy Director, Space Access and Exploration Program Office, as that person. (m.p.saunders@larc.nasa.gov). In my communications, I indicated that if LaRC could provide such a name, I would ask all of Code Q to work through that person.

Thanks, Pam

~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~

Pamela F. Richardson
Aerospace Technology Mission Assurance Manager
Enterprise Safety and Mission Assurance Division, Code QE
Office of Safety and Mission Assurance, NASA Headquarters
300 E. Street, S. W., Washington, DC 20546
phone: 202-358-4631, fax: 202-358-2778

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"The meek can *have* the Earth. The rest of us are going to the stars." --- Robert Heinlein
"We have to learn to manage information and its flow. If we don't, it will all end up in turbulence." --- RADM Grace Hopper

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X-Sender: wfrazier@mail.hq.nasa.gov
X-Mailer: QUALCOMM Windows Eudora Version 4.3.2
Date: Tue, 11 Feb 2003 14:05:58 -0500
To: Newberry Stan SES AFSPC/NASA <Stan.Newberry@PETERSON.af.mil>
From: "Wayne R. Frazier" <wfrazier@hq.nasa.gov>
Subject: RE: February 2, 2003
Cc: jlemke@hq.nasa.gov, jmullin@hq.nasa.gov

We were looking to update our current MOU it but it might be lost in the priorities now. Jon Mullin in this office is POC. I am curious if our MOU is the same as yours. Our MOU is with the DOD and signed by Juliana and Culbertson, but it is 1982.

Wayne

At 05:39 PM 2/11/2003 +0000, you wrote:
Thanks, Wayne. I have spoken to Maj Ramey a couple of times. We provided him the old MOU related to NASA and the Air Force yesterday. The only other thing I think he needs is the Charter when you are able to provide it. Also, can you tell me if the MOU is being revised? I saw it was signed in 1982. Thanks again.
Stan

-----Original Message-----
From: Wayne R. Frazier [mailto:wfrazier@hq.nasa.gov]
Sent: Tuesday, February 11, 2003 5:02 AM
To: stan.newberry@peterson.af.mil
Cc: prichard@hq.nasa.gov; jlemke@hq.nasa.gov; jmullin@hq.nasa.gov
Subject: February 2, 2003

stan,

Copy of appointment letter. I am trying to get the charter, either old version or new.
Maj Ramey of the legal office called us.
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"

X-Sender: jmullin@mail.hq.nasa.gov
X-Mailer: QUALCOMM Windows Eudora Version 4.3.2
Date: Tue, 11 Feb 2003 11:29:33 -0500
To: "Joyner, Gloria" <Gloria.Joyner@fema.gov>
From: "Jonathan B. Mullin" <jmullin@hq.nasa.gov>
Subject: RE: Columbia Updates

Thanks, I have not seen them on the screen as of this time. Again, thank for your help. Regards, Jon
At 11:27 AM 2/11/2003 -0500, you wrote:
Jon:

I understand an update was sent. Please let me know if you ned anything
else from FEMA.

Gloria

-----Original Message-----
From: Jonathan B. Mullin [mailto:jmullin@hq.nasa.gov]
Sent: Tuesday, February 11, 2003 11:04 AM
To: Gloria.Joyner@fema.gov
Cc: whill@hq.nasa.gov
Subject: Columbia Updates

Gloria, just a note to follow up on a call I placed to the EST this
morning. I spoke with the EST indicating that NASA had not received any
situation updates from the field since yesterday at 1229 hours.
Apparently reports were sent but we did not receive them. Is there a
problem I need to address?
Regards, Jon

Jonathan B. Mullin
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Emergency Preparedness Coordinator
Headquarters National Aeronautics and Space Administration
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Jonathan B. Mullin
Manager Operational Safety
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X-Sender: wharkins@mail.hq.nasa.gov
X-Mailer: QUALCOMM Windows Eudora Version 4.3.2
Date: Tue, 11 Feb 2003 09:11:25 -0500
To: snewman@hq.nasa.gov
From: Wilson Harkins <wharkins@hq.nasa.gov>
Subject: Fwd: CAC Code M, B, U, Q action required

Steve,

I'm doing some leg work for this task and I don't see any indications in the CAC data collections of any of the assessments that Code Q has performed related to ET, shuttle processing, etc. Do you have a list of all of the assessments that you've been involved in performing related to the shuttle that I could add to their info sources? If you have electronic versions let me know how I can get copies of them as well. Thanks.

v/r

Wil

X-Sender: jlloyd@mail.hq.nasa.gov
X-Mailer: QUALCOMM Windows Eudora Version 4.3.2
Date: Mon, 10 Feb 2003 08:53:47 -0500
To: Pamela Richardson <prichard@hq.nasa.gov>
From: James Lloyd <jlloyd@hq.nasa.gov>
Subject: Fwd: CAC Code M, B, U, Q action required
Cc: wharkins@hq.nasa.gov, , wfrazier@hq.nasa.gov,
prutledg@hq.nasa.gov, jlemke <jlemke@hq.nasa.gov>

Pam, would you and Wil Harkins coordinate with others named in this message to develop the mentioned briefing book materials to include the topics assigned Code Q as a role. We probably have this stuff; it needs to be assembled for insertion.

X-Sender: mkowales@mail.hq.nasa.gov
X-Mailer: QUALCOMM Windows Eudora Version 4.3.2
Date: Mon, 10 Feb 2003 08:25:07 -0500
To: jlloyd@mail.hq.nasa.gov, prutledg@mail.hq.nasa.gov
From: Mark Kowaleski <mkowales@hq.nasa.gov>
Subject: Fwd: CAC Code M, B, U, Q action required

X-Sender: astockin@mail.hq.nasa.gov
X-Mailer: QUALCOMM Windows Eudora Version 4.3.2
Date: Fri, 07 Feb 2003 13:54:49 -0500
To: rdavis@hq.nasa.gov, hrothman@hq.nasa.gov, rcooper@hq.nasa.gov,
dmcsween@hq.nasa.gov, dcornstoc@hq.nasa.gov, rstephen@hq.nasa.gov,

mark.kowaleski@hq.nasa.gov, gmartin@hq.nasa.gov, jbingham@hq.nasa.gov, astockin@hq.nasa.gov, wbierbow@hq.nasa.gov, adiaz@hq.nasa.gov
From: Ashley Stockinger <astockin@hq.nasa.gov>
Subject: Fwd: CAC Code M, B, U, Q action required
Cc: HCATinfo@hq.nasa.gov

CAC Group:

As you all may know, a briefing book for the Administrator is being developed due tomorrow. Code P has divided the content of the book into the following areas:

- STS-107 crew & families
- Debris collection
- Investigation Status
- Gehman board
- NASA Budget
- Safety & Reporting Procedures
- ISS Future
- Science Impact
- Previous Reports on Shuttle, Tiles and External Tank
- Agency Program Impacts

It seems that a great deal of work is being done on this by many different people and on many different levels. So as not to duplicate our efforts I suggest the following:

Code M take action of STS-107 crew & families, debris collection, Investigation Status, Gehman board, and ISS Future
Code B take action of NASA Budget
Code Q/M take action of safety and reporting procedures
Code U take action of Science impact
Code M/Q take action of previous reports on Shuttle, Tiles and External Tank

A great deal of previously approved information about these topics can be found on the X drive under CAC in the resources file.

Any questions regarding these topics should be addressed to Code P CAC rep. Rich Cooper x1774

Thank you,
Ashley Stockinger

Ashley K. Stockinger
Office of Space Flight
NASA Headquarters
Phone: (202) 358-2397

Fax: (202) 358-2983

Jim

X-Sender: jmullin@mail.hq.nasa.gov
X-Mailer: QUALCOMM Windows Eudora Version 4.3.2
Date: Wed, 19 Feb 2003 09:24:11 -0500
To: snakamur@ems.jsc.nasa.gov
From: "Jonathan B. Mullin" <jmullin@hq.nasa.gov>
Subject: Space Shuttle Mishap Information Request
Cc: jlemke@hq.nasa.gov, jlloyd@hq.nasa.gov, tom.whitmeyer@hq.nasa.gov

Stacey, reference your earlier undefined request for IRIS Data.

First, I understand the that **all of the CAIB requests need to be managed through a single point, The Task Group , Mr. Buzzard.**

Secondly, In order to respond, please state the request specifically "by the numbers." Responses must be standardized from the agency to the CAIB. ILL defined requests will get you mixed data.

Thirdly, all mishap data that the CAIB may be seeking, may not have have been put into IRIS. Consider all of the "floor paper" where less than a $1,000 damage may have occurred. Consider, PRACA, MRB actions, open paper anomalies, etc. that are part of Quality Paper documentation. Another feature to be reviewed would be the records of the contractor, such as the Incident Error Review Board (IERB) which has been extensively exercised at the Kennedy Space Center.

Fourth, consider what reports may have been made to the NASA Contracting Officer with respect to damage during this period of time.

With the potential sensitivity of this data, who is (are ) the government official (s) assuring the process?

For my information, please copy me on the defined request.
..
Regards, Jon

Jonathan B. Mullin
Manager Operational Safety
Emergency Preparedness Coordinator
Headquarters National Aeronautics and Space Administration
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FAX (202) 358-3104
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X-Sender: jmullin@mail.hq.nasa.gov
X-Mailer: QUALCOMM Windows Eudora Version 4.3.2
Date: Tue, 11 Feb 2003 07:45:09 -0500
To: James Lloyd <jlloyd@hq.nasa.gov>
From: "Jonathan B. Mullin" <jmullin@hq.nasa.gov>
Subject: Re: AIR Force Request.
Cc: jlemke@hq.nasa.gov, wfrazier@hq.nasa.gov, prichard@hq.nasa.gov,
sbrookov@hq.nasa.gov, Daniel Thomas <dthomas1@hq.nasa.gov>

Jim, as I see it the DOD /Agreement is not applicable in this investigation. We have used it on "like systems" investigations, that is common aircraft and common missiles;for example (NASA MSFC) participated in the Titian 4 segment mishap at Ed wards AFB in the 90's.

Code QS returned the call Major Ramey and indicated that the DOD/NASA agreement was not the authority for the investigation, instead the Space Act was the authority.

Learning that fact, last evening the AF requested a "copy of the Board Appointment Letter " signed out by Mr. O'Keefe .
I highly suggest that Code Q elect our legal Code G as the "formal " response agent to the Air Force concerning this matter.
Regards, Jon
At 05:55 PM 2/10/2003 -0500, you wrote:
Why would we use the DOD memo as a citation for investigation of a loss of a Shuttle? The memorandum is to be used as a citation for sharing information and requesting support but all that had been done as part of the establishment of the Standing Board which I recall may have used the DOD/NASA agreement. What this infers is anyone's guess.

At 04:48 PM 2/10/2003 -0500, Jonathan B. Mullin wrote:
Code QS got a call from AF Space Command Major Robert Ramey, Legal Office. He wanted to know if the NASA DOD Agreement was being used as a citation for the Columbia Investigation. MR. Fraizier and I responded that the Space Act was being used as the authority.
Major Raymey can be reached at 719-554-5494. His FAX is 719-554-9095 and email is robert.ramey@peterson.af.mil
Major Ramey indicated he would like a copy of the appointment letter, which QS replied we could should send it through our NASA Liason at Peterson AFB, Mr. Newbury.
Regards, Jon

Jonathan B. Mullin
Manager Operational Safety
Emergency Preparedness Coordinator
Headquarters National Aeronautics and Space Administration
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Jim

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X-Sender: wfrazier@mail.hq.nasa.gov
X-Mailer: QUALCOMM Windows Eudora Version 4.3.2
Date: Tue, 11 Feb 2003 06:55:54 -0500
To: James Lloyd <jlloyd@hq.nasa.gov>
From: "Wayne R. Frazier" <wfrazier@hq.nasa.gov>
Subject: Re: AIR Force Request.
Cc: jmullin@hq.nasa.gov, jlemke@hq.nasa.gov

Yes, not sure what he was after. He has been talking to Stan Newberry our residence office person out there.
Stan also wants a copy of the charter which we will provide electronically or fax.

At 05:55 PM 2/10/2003 -0500, you wrote:
Why would we use the DOD memo as a citation for investigation of a loss of a Shuttle? The memorandum is to be used as a citation for sharing information and requesting support but all that had been done as part of the establishment of the Standing Board which I recall may have used the DOD/NASA agreement. What this infers is anyone's guess.

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Jim

~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~

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

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X-Sender: jlloyd@mail.hq.nasa.gov
X-Mailer: QUALCOMM Windows Eudora Version 4.3.2
Date: Mon, 10 Feb 2003 17:55:15 -0500
To: "Jonathan B. Mullin" <jmullin@hq.nasa.gov>, jlemke@hq.nasa.gov
From: James Lloyd <jlloyd@hq.nasa.gov>
Subject: Re: AIR Force Request.
Cc: prichard@hq.nasa.gov, prutledg@hq.nasa.gov, wfrazier@hq.nasa.gov

Why would we use the DOD memo as a citation for investigation of a loss of a Shuttle? The memorandum is to be used as a citation for sharing information and requesting support but all that had been done as part of the establishment of the Standing Board which I recall may have used the DOD/NASA agreement. What this infers is anyone's guess.

At 04:48 PM 2/10/2003 -0500, Jonathan B. Mullin wrote:
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Regards, Jon

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Emergency Preparedness Coordinator
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Jim

X-Authentication-Warning: spinoza.public.hq.nasa.gov: majordom set sender to owner-press-release using -f
Date: Wed, 12 Feb 2003 11:50:29 -0500 (EST)
From: NASANews@hq.nasa.gov
Subject: Administrator's Congressional Statement Online
Sender: owner-press-release@lists.hq.nasa.gov
To: undisclosed-recipients:;

February 12, 2003

Advisory to news media:

Administrator's Congressional Statement Online

Due to the length of Administrator Sean O'Keefe's statement before the Senate Committee on Commerce, Science and Transportation and the House Subcommittee on Space and Aeronautics Committee on Science, it is not being distributed to this list. The entire statement has been posted to:

http://www.nasa.gov/formedia/MP_okeefe_hearing_030212.pdf

For additional information, contact the NASA Headquarters Newsroom, 202/358-1600.

- end -

* * *

X-Sender: eraynor@mail.hq.nasa.gov
X-Mailer: QUALCOMM Windows Eudora Version 4.3.2
Date: Mon, 10 Feb 2003 16:01:25 -0500
To: jlloyd@hq.nasa.gov, jlemke@hq.nasa.gov, prutledg@hq.nasa.gov
From: Eric C Raynor <eraynor@hq.nasa.gov>
Subject: NSRS Reports Pertaining to Shuttle
Cc: wharkins@hq.nasa.gov, prichard@hq.nasa.gov, jlyver@hq.nasa.gov,
whill@hq.nasa.gov, mkowales@hq.nasa.gov

I asked the NSRS contractor to review all NSRS reports, received since the inception of the program, to try to determine how many pertained to the shuttle program. There are 211 such reports (out of a total of 564 reports).

I have a list of them, identified by ascension number only. Any further analysis of these reports and their possible relevancy to the loss of Columbia would probably require a review of each report file by a person who is well-versed in shuttle program operations. With sufficient advance notice these files can be made available for review or inspection. The files are stored at the contractor's facility in Bethesda, Maryland.

-Eric

---

Eric Raynor, Program Analyst
Code QS - Safety and Assurance Requirements Division
Office of Safety and Mission Assurance
NASA Headquarters, Washington, DC 20546

Phone: 202-358-4738
Fax: 202-358-3104
Email: eraynor@hq.nasa.gov

---

NSRS: http://www.hq.nasa.gov/nsrs
NSRS Intranet: http://nsrs-pbma-kms.intranets.com
LLIS: http://llis.nasa.gov
LLIS Intranet: http://llsc-pbma-kms.intranets.com
GIDEP: http://www.gidep.org
GIDEP Intranet: http://gidep-pbma-kms.intranets.com
SOLAR: https://solar.msfc.nasa.gov
Code Q Homepage: http://www.hq.nasa.gov/office/codeq

---

X-Sender: jlloyd@mail.hq.nasa.gov
X-Mailer: QUALCOMM Windows Eudora Version 4.3.2
Date: Tue, 11 Feb 2003 18:32:18 -0500
To: Pamela Richardson <prichard@hq.nasa.gov>
From: James Lloyd <jlloyd@hq.nasa.gov>
Subject: Fwd: Offer of help
Cc: prutledg@hq.nasa.gov, jlemke <jlemke@hq.nasa.gov>

Here's an offer of services.

X-Sender: tpfitzer@mail.apt-research.com
Date: Tue, 11 Feb 2003 17:16:48 -0600
To: jlloyd@hq.nasa.gov
From: Tom Pfitzer <tpfitzer@apt-research.com>
Subject: Fwd: Offer of help
Cc: yutmeyer@apt-research.com, "Sid Smith" <ssmith@apt-research.com>

Hi Jim,
We haven't talked in a while but I thought that I would forward this to you also in case there was any analyses you need for the Columbia accident. We have also sent it to our contacts at MSFC.

Also, we at APT are continuing to push the state of the art in risk based analyses and decision making and would like to give you an update sometime when we are in DC. Pete and I come up every month or two.

I hope things are well with you.
Tom

From: "Sid Smith" <ssmith@apt-research.com>
To: "tom pfitzer" <tpfitzer@apt-research.com>, <amanda.gibson@msfc.nasa.gov>
Subject: Offer of help
Date: Tue, 11 Feb 2003 14:54:35 -0600
X-Priority: 3 (Normal)
Importance: Normal

Amanda,

We at APT Research have strong analytical capabilities in the areas of debris prediction, fault tree analysis, reliability analysis, and process flow analysis. Our models for predicting the ground hazard from de-orbiting debris use methods we developed for the Natoinal Ranges and are at the state of the art in safety modeling.

We have frequently been used as an independent source for safety analysis. As such, we are comfortable with the analysis of systems and processes where we were not a part of the original design team. If you see a need for such a capability for the Shuttle program, we could provide a truly independent look at the processes and analyses that are being used to examine the Columbia disaster.

We are available to provide assistance in any way that we can.

Sid Smith
APT Research
327-3397

Jim

X-Sender: jlloyd@mail.hq.nasa.gov
X-Mailer: QUALCOMM Windows Eudora Version 4.3.2
Date: Thu, 13 Feb 2003 08:27:12 -0500
To: salexand@hq.nasa.gov, elvia h thompson <ethompso@mail.hq.nasa.gov>,
cac <cac@hq.nasa.gov>, hcat@hq.nasa.gov, jmannix@hq.nasa.gov
From: James Lloyd <jlloyd@hq.nasa.gov>
Subject: ASAP minutes in regard to concerns of MMOD Damage and
Mitigating Responses to Threat
Cc: wfrazier@mail.hq.nasa.gov, jlemke <jlemke@hq.nasa.gov>,
prutledg@hq.nasa.gov, mark Kowaleski <mkowales@hq.nasa.gov>,
prichard@hq.nasa.gov

Not sure who is now leading the collection of reports that may instigate questions but here is one that is in the public domain and has information on MMOD risks.

http://www.nap.edu/books/0309059887/html/index.html

X-Sender: wfrazier@mail.hq.nasa.gov
X-Mailer: QUALCOMM Windows Eudora Version 4.3.2
Date: Wed, 12 Feb 2003 07:08:52 -0500
To: James Lloyd <jlloyd@hq.nasa.gov>
From: "Wayne R. Frazier" <wfrazier@hq.nasa.gov>
Subject: Re: ASAP minutes
Cc: jlemke@hq.nasa.gov, mkowales@mail.hq.nasa.gov, wbihner@hq.nasa.gov,
lsirota@hq.nasa.gov

Yesterday, I received from Nick Johnson a fax of Tommy Holloway's response to the 1997 NRC Report concerning the risk of OD damage to the orbiter. The report chaired by Rick Hauck, former astronaut and now a DC area space insurance executive, is very prophetic when is comes to some of the risk scenarios I have read about in the paper.

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W

At 06:22 PM 2/11/2003 -0500, you wrote:
**Len,**

**I have excerpted a section from the November 7, 2002 minutes of the open ASAP meeting at Houston. These minutes are on the web site and freely open to public. Buried very carefully in the Aviation Safety section (:>)) you can find a reference to the need to do more fact finding on on-orbit repair capability in the face of the enhanced risk of MMOD damage on extended duration stays. This is what the AP reporter wants to interview someone about. Elvia Thompson, PAO, says the reporter is also looking for the NASA response to this. Since it**

**isn't even a recommendation, let alone a report to NASA, I suspect people have not had a chance to even know that this observation/need to fact find even exists. The entire report is 7 pages in length and is a PDF located at:**

**http://www.hq.nasa.gov/office/codeq/asapmeet/11_7_2003.pdf**

**Messrs. Goranson and Guiterrez are the ASAP members with the stated interest.**

**Aviation Safety**
Mr. Gutierrez discussed the continuing Panel concern about who the Center Aviation Safety Officers report to. The ASAP has consistently taken the position that the ASO should report directly to the Center Directors. NASA does not have a consistent organization across all Centers and does not believe this structure is necessary to have a safe operation. It was agreed that the issue would be closed in the Annual Report with an agreement to disagree.

Mr. Gutierrez also mentioned the SATS program and the no-fly zone concerns as possible issues which would be addressed in the visit to LaRC the following week.

Mr. Goetz noted that Orbital Debris was still an open issue that needed to be addressed. Ms. McCarty wanted the funding status of the JSC capability to be included in the next JSC briefing. Messrs. Goranson and Gutierrez desire more fact-finding about on-orbit vehicle repair techniques and characteristics for extended on-orbit durations.

Mr. Schaufele discussed the common issues of Second Generation launch vehicles, SLI, CRV, CTV and upgrades. The requirements have not been adequately defined, have not considered full lifecycle costs, have not been focused on a long-range NASA vision and have not had adequate focus on safety. The inter-relationship between SLI and CRV/CTV need to be considered as well as the compatibility of the CRV/CTV with EELV's. It was noted that the Integrated Space Transportation Plan, currently under NASA review, would address the requirements of these programs.

Jim

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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

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*"Mission success starts with safety"*

X-Sender: wfrazier@mail.hq.nasa.gov
X-Mailer: QUALCOMM Windows Eudora Version 4.3.2
Date: Wed, 12 Feb 2003 14:11:53 -0500
To: jlloyd@hq.nasa.gov, jlemke@hq.nasa.gov, prutledg@hq.nasa.gov
From: "Wayne R. Frazier" <wfrazier@hq.nasa.gov>
Subject: AFTAC support to CAIB and MIT
Cc: prichard@hq.nasa.gov

Several days ago, I received an offer from Mr. Bill Hungate, an ARMY contractor (AFTAC) at Patrick AFB in FL, who indicated they had access to a side looking hyperspectral scanner which could be used to support the CAIB ground debris effort. Thru Bill Hill I had originally put him in touch with the FEMA ops center in Lufkin, but he called me back to indicate that he has not been able to get in contact with anyone there. I gave him Dave Whittle's number and subsequently spoke to Dave Whittle who indicated he would contact him. This cabability is in place and can be flown immediately to support debris location and categorization especially after getting the signatures needed from the pieces already recovered. This offer is free to NASA--all that is needed is a phone call or fax or something from NASA requesting it.

When I talked to Dave Whittle, he indicated he would call him.

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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

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X-Mailer: QUALCOMM Windows Eudora Version 4.3.2
Date: Thu, 13 Feb 2003 08:27:12 -0500
To: salexand@hq.nasa.gov, elvia h thompson <ethompso@mail.hq.nasa.gov>,
cac <cac@hq.nasa.gov>, hcat@hq.nasa.gov, jmannix@hq.nasa.gov
From: James Lloyd <jlloyd@hq.nasa.gov>
Subject: ASAP minutes in regard to concerns of MMOD Damage and
Mitigating Responses to Threat
Cc: wfrazier@mail.hq.nasa.gov, jlemke <jlemke@hq.nasa.gov>,
prutledg@hq.nasa.gov, mark Kowaleski <mkowales@hq.nasa.gov>,
prichard@hq.nasa.gov

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From: "Wayne R. Frazier" <wfrazier@hq.nasa.gov>
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lsirota@hq.nasa.gov

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</x-html>

Jim

X-Authentication-Warning: spinoza.public.hq.nasa.gov: majordom set sender to owner-code-q using -f
X-Sender: mstamate@mail.hq.nasa.gov
X-Mailer: QUALCOMM Windows Eudora Version 4.3.2
Date: Thu, 13 Feb 2003 15:26:49 -0500
To: code-q@lists.hq.nasa.gov
From: Michael Stamatelatos <mstamate@hq.nasa.gov>
Subject: Fwd: Excite News
Sender: owner-code-q@lists.hq.nasa.gov

For your information.

Date: Thu, 13 Feb 2003 14:36:17 -0500
From: Joseph R Fragola <fragola@prodigy.net>
Reply-To: fragola@prodigy.net
Organization: Science Applications
X-Mailer: Mozilla 4.79 (Macintosh; U; PPC)
X-Accept-Language: en
To: Doyle McDonald <fdole@swbell.net>,
"Railsback, Jan" <jan.railsback1@jsc.nasa.gov>,
Michael Stamatelatos <mstamate@hq.nasa.gov>
Subject: Excite News

FYI
http://apnews.excite.com/article/20030213/D7P5UILG2.html

**Landing Gear Suspect in Shuttle Disaster**
Email this Story

Feb 13, 1:52 PM (ET)

By TED BRIDIS

WASHINGTON (AP) - NASA confirmed Thursday one sensor aboard Columbia indicated its left landing gear was improperly lowered moments before it disintegrated over Texas as it raced through earth's atmosphere at more than 12,000 miles per hour. But it said other sensors conflicted with those readings.

The disclosure focused renewed attention on possible catastrophic failures inside Columbia's wheel compartment inside its left wing that may have attributed to the mysterious breakup.

Safety engineers believe an unusually large chunk of flyaway foam from Columbia's external tank struck the shuttle on liftoff and may have damaged delicate insulating tiles near that area, but they concluded Columbia could return safely.

NASA spokesman William Jeffs at Johnson Space Center confirmed that one sensor indicated Columbia's gear was lowered as it raced over Texas at 209,000 feet and flying at 18 times the speed of sound - far too high and too fast for that to happen. But Jeffs cautioned that two other sensors at the time indicated the gear was still properly raised.

"We're not certain if the readings showed the landing gear deployed or were the result of a

faulty sensor that sent bad data," Jeffs said. "One indicated (the wheel) was down and locked, and that was shortly before radio contact with the orbiter was lost."

NASA dislosed Wednesday that a safety engineer wrote two days before Columbia's mysterious breakup about risks to the shuttle from "catastrophic" failures caused by tires possibly bursting inside the spacecraft's wheel compartment from extreme heat.

Robert H. Daugherty, responding to an inquiry from Johnson Space Center, cautioned in an e-mail to NASA colleagues that damage to delicate insulating tiles near Columbia's landing gear door could cause one or more tires inside to burst, perhaps ending with catastrophic failures that would place the seven astronauts "in a world of hurt."

Such an explosion inside Columbia's belly, Daugherty predicted, could blow out the gear door and expose the shuttle's unprotected innards to searing temperatures as it raced through earth's atmosphere.

Ret. Admiral Harold Gehman, who heads the panel investigating the Columbia accident, on Thursday called Daugherty's e-mail "one of the many, many interesting leads that we have."

On the same day NASA disclosed the contents of Daugherty's e-mail, searchers near Hemphill, Texas, about 140 miles northeast of Houston, recovered what they believed to be one of Columbia's tires.

The tire was blackened and sustained a massive split across its tread, but it was impossible from photographs to know whether the tire was damaged aboard Columbia or when it struck the ground.

NASA officials in Washington and Houston on Thursday said they could not confirm the tire was the shuttle's, but one person familiar with tires on the orbiter looked at a photograph of the tire found in Texas and said it appeared to be from a shuttle.

In his e-mail, which included remarkably strident language, Daugherty wrote that even if astronauts survived the heat, the blast could damage critical systems inside the wheel compartment, prevent the landing gear on one side from lowering, necessitate a risky belly landing or force the crew to bail out.

Bailing out would be "not a good day," he wrote. But attempting to fly the shuttle with only one side's landing gear lowered would be worse: "You're finished."

Flight Director Leroy Cain said Wednesday that investigators were confident the gear door did not fall off in flight because such a failure would have been indicated on sensor readings.

Other NASA officials have cited mysterious sensor readings in the wheel well moments before Columbia's breakup but have said they were confident the tire didn't burst inside the shuttle.

Daugherty acknowledged these were "absolute worst-case scenarios," adding, "I don't really believe things are as bad as I'm getting ready to make them out." But he defended raising the issues in e-mail to avoid a "gut-wrenching decision" days later during Columbia's descent.

Daugherty on Wednesday referred questions about his concerns to a NASA spokesman. Agency officials indicated they did not want reporters to speak with Daugherty because accident investigators had not yet questioned him. NASA disclosed the contents of his e-mail

Wednesday.

The e-mail from Daugherty, an engineer at NASA's Langley research facility in Hampton, Va., was prompted by a telephone call Jan. 27 from experts at the Johnson Space Center in Houston who asked what might happen if Columbia's tires were not inflated when it attempted to land.

The inquiry from Johnson has attracted interest because it came four days after engineers at The Boeing Co. (BA), a contractor, assured NASA that Columbia could return safely despite damage to left wing tiles that might have occurred on liftoff.

Senior NASA officials said Daugherty's concerns were part of a "what-if" analysis by a small group of engineers who already had been assured that Columbia would land safely. They acknowledged that concerns about threats to the shuttle's tires were not passed along to NASA flight directors.

Milt Heflin, chief of the flight director's office, said Daugherty and others involved in the tire questions "were happy with the analysis and the work that was done" by Boeing. "They were continuing to do more what-if'ing."

An e-mail back to Daugherty the next day from a Johnson Space Center engineer, David F. Lechner of the United Space Alliance LLC, another NASA contractor, thanked Daugherty for his "candid remarks." He said they "generated extremely valuable discussion in our group."

"We hope the debris impact analysis is correct and all this discussion is mute," Lechner wrote.

Another Langley employee, Mark J. Shuart, responded by e-mail later that day, "Looks like they believe all this has been addressed." His message was time-stamped about 20 hours before the shuttle disintegrated.

Senior NASA officials have repeatedly expressed confidence in Boeing's conclusions, which predicted "safe return indicated" even if foam insulation that fell from Columbia's external fuel tank had caused "significant tile damage." That study assumed foam debris struck part of Columbia's left wing, including its toughened leading edge and the thermal tiles covering the landing gear.

Testifying at a joint congressional hearing Wednesday, NASA Administrator Sean O'Keefe told lawmakers that during Columbia's 16-day mission, "there were no abnormalities that would suggest a problem. If there was any indication, they would have showed up."

Among the earliest warning signs aboard Columbia in the minutes before its demise was an unusual heat buildup of about 30 degrees inside the left wheel well. Investigators have said they are confident the tire inside didn't deflate, but they have been unable to explain the readings.

**Articles From AP**

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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"**

X-Authentication-Warning: spinoza.public.hq.nasa.gov: majordom set sender to owner-press-release using -f
Date: Wed, 19 Feb 2003 09:20:25 -0500 (EST)
From: NASANews@hq.nasa.gov
Subject: UPDATE: ASSESSMENT OF SCIENCE DATA GAINED DURING COLUMBIA'S MISSION
Sender: owner-press-release@lists.hq.nasa.gov
To: undisclosed-recipients: ;

Dolores Beasley
Headquarters, Washington
(Phone: 202/358-1753)

Feb. 19, 2003

RELEASE: 03-074

# UPDATE: ASSESSMENT OF SCIENCE DATA GAINED DURING COLUMBIA'S MISSION

NASA scientists are continuing to assess the status of the data received by the experiments onboard Space Shuttle Columbia (STS-107) during its final mission. Columbia carried more than 80 experiments, science, commercial and student, on a 16-day mission devoted to research, entrepreneurship and education.

"For those experiments that received down-linked data during the mission, we estimate that anywhere between 50-90 percent of the data was acquired," said David Liskowsky, STS-107 Program Scientist for NASA's Office of Biological and Physical Research (OBPR). Most of these experiments were in the physical science disciplines of combustion research, material sciences, and fluid physics. For most of the life sciences experiments, data and specimens were to be recovered on landing, so no data is available.

The OBPR science project teams report the overall performance of the experimental hardware and equipment employed on the mission was highly successful, with 100 percent operational success being achieved for virtually all of the experiments. "In addition to the scientific data that was collected from the mission, this operational success provides a measure of the robustness and capability of conducting high quality research on the Shuttle," Liskowsky said.

During the past week, researchers determined:

? The Mechanics of Granular Materials (MGM) investigators estimate that careful analysis of the downlinked data

should result in achieving 50 to 60 percent of their science goals. The MGM experiment used the microgravity of orbit to test sand columns under conditions that cannot be obtained from experiments on Earth. The knowledge gained from this will be applied to improving foundations for buildings and increasing understanding of how earthquakes and other forces disturb grains of soil and sand.

? Almost all of the data from Critical Viscosity of Xenon, an experiment sponsored by the National Institute of Standards and Technology, was acquired before the end of the mission. This experiment measured the changes in viscosity (resistance to flow) of xenon, a pure fluid with a very simple structure and a critical temperature just below room temperature. The data may help scientists better understand shear thinning in complex fluids such as paints and foods (e.g., whipped cream), which need to flow easily during application and stand firm afterwards.

? STARNAV, a star tracker navigation system from Texas A&M University accomplished all of its objectives. This educational experiment was designed to determine precise spacecraft attitude without prior knowledge of position.

? SPACEHAB's Space Media commercial payload, STARS, saw many amazing results on this mission. As part of an education program with experiments designed by students, the STARS payload (www.starsprogram.com) received daily downlink of video, photos, humidity and temperature readings. Students from Australia, China, Israel, Japan, Liechtenstein, and the United States designed these six experiments. They were able to achieve approximately 70 percent of their scientific objectives, providing unique insight into the low gravity impact on the behavior and development of ants, bees, silkworms, and fish eggs, the random crystal growth of cobalt and calcium, and the web spinning ability of spiders.

? The Solar Constant Experiment (SOLCON), managed by the Royal Meteorological Institute of Belgium and sponsored by NASA, was designed to measure the solar constant and identify variations in the value during a solar cycle. This experiment was a 100 percent success. The data

will ensure continuity of the solar constant level obtained by instruments mounted on free flyers, over climate time scale duration.

? The Low Power Transceiver (LPT) experiments were completed and 100 percent of the data collected. These experiments demonstrated LPT's ability to do simultaneous communications and on-board navigation in space. The data from this experiment may provide more cost-effective space operations in future satellites

? The Mediterranean Israeli Dust Experiment (MEIDEX) acquired an image of a pall of gray smoke hanging above the Amazon rainforest illustrating how complex interactions between smoke and the atmosphere can influence weather and climate.

The final results from these and other experiments will be determined in the coming months as the acquired data are analyzed. More information about the research performed by the Columbia crew is available on the Internet at:

http://spaceresearch.nasa.gov

-end-

* * *

From: "Schilder, Craig, Mr, OSD-ATL" <Craig.Schilder@osd.mil>
To: "John lemke (JLemke@hq.nasa.gov)" <JLemke@hq.nasa.gov>
Subject: Shuttle Panel Names Experts to Aid Inquiry. tm
Date: Tue, 25 Feb 2003 08:07:39 -0500
X-Mailer: Internet Mail Service (5.5.2653.19)

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**February 25, 2003**

## Shuttle Panel Names Experts to Aid Inquiry

**By MATTHEW L. WALD**

OUSTON, Feb. 24 - The independent board investigating the Columbia crash this evening released the names of 21 experts who are assisting its work. They are drawn from active and retired personnel from the military, the National Transportation Safety Board and the Federal Aviation Administration and from the naval nuclear propulsion program and other government agencies.

"The board is putting together a group of safety experts and scientists and experienced investigators to help determine the cause of the space shuttle accident independent of NASA," said a spokeswoman, Laura J. Brown, herself on loan from the F.A.A. The experts, who will be joined by others, will "enable the board to analyze information that comes from NASA, but also to do our own analysis in some cases," Ms. Brown said.

The board's charter was written as a response to the crash of the shuttle Challenger 17 years ago, but since the board was convened on a conference call a few hours after the Feb. 1 crash, its structure has drawn criticism from lawmakers and others as not being sufficiently independent of NASA. In response, NASA has modified the board's charter, and its chairman, Harold W. Gehman Jr., a retired admiral, has added members.

This evening, David J. Goldston, chief of staff of the House Science Committee, said he did not believe that the committee chairman, Sherwood Boehlert, Republican of New York, who had been among the critics, had seen the new list of experts. But, he said: "We're pleased the board has begun to hire staff. The board's made clear from the beginning that they intend to have capability independent of NASA, and anything they can do in that vein, we support."

Some of the experts whose identities were announced today are military officers who are assistants to the board members and have been at work since just after the crash; others have arrived more recently.

The board, which initially borrowed workspace from NASA, has now secured commercial office space near the Johnson Space Center. It will hold a briefing Tuesday at the same auditorium at the space center that NASA uses for news conferences, but plans to hold future briefings off NASA premises, Ms. Brown said. It will also move off NASA's Web site; beginning Tuesday, it will post information at its own site, www.caib.us. The board has also opened a phone line for government employees, contractors and members

of the public who want to communicate with it, (888) 703-2242.

The board has planned its first hearings for March 6, at the University of Houston's Clear Lake campus. The topics and witness list have not been announced.

Among the staff members announced today was Dr. James P. Bagian, who flew on the Discovery in 1989 and the Columbia in 1991 and supervised the recovery of the Challenger's crew capsule after it was destroyed on liftoff in 1986. Dr. Bagian is an adjunct assistant professor of military and emergency medicine at the Uniformed Services University of Health Sciences.

The board also named two high-ranking investigators at the National Transportation Safety Board, Thomas Haueter and Gregory Phillips. Both were deeply involved in one of the most challenging air crash investigations of the last 20 years, USAir 427, a Boeing 737 with a rudimentary flight data recorder that flipped over and crashed on approach to Pittsburgh International Airport in 1995.

The board also named Paul D. Wilde, an aerospace engineer at the F.A.A.'s licensing and safety division, who specializes in rocket safety, and Ronald K. Gress, who retired from the aviation agency as associate administrator for the office of commercial space transportation.

The staff also includes Howard E. Goldstein, who, along with Dr. Bagian, has a direct NASA connection. He retired in 2000 as the chief scientist of the space technology division at the NASA Ames Research Center. According to the board, he "initiated the research program for development of materials that are now major components of the thermal protection system" of the shuttles.

Other staff members include a retired brigadier general, Thomas Carter, who is a former deputy assistant secretary of defense and was an assistant to Bob Dole when he was the Senate Republican leader.

The list includes five people with lengthy careers in naval nuclear propulsion: Thomas L. Foster, who later conducted a variety of studies for the Navy; Jim Mosquera, an engineer; Gary Olson, a budgeting and planning expert; David B. Pye, who retired in 2001 as a reactor engineering manager; and James W. Smiley, who participated in the investigation of the 1979 reactor accident at the Three Mile Island power plant.