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

July 5, 2002

Reply to Attn of: Q.1

Memorandum for the Record

Pursuant to the provisions of the Federal Advisory Committee Act (Public Law 92-463, October 6, 1972) and NASA Policy Directive 1150.21, entitled "Establishment, Operation and Duration of NASA Advisory Committees," the enclosed minutes of the Aerospace Safety Advisory Panel's Plenary Meeting conducted on June 20, 2002, at Huntsville, Alabama, are submitted for the record.

David M Lengyel
Executive Director Aerospace
Safety Advisory Panel

Shirley C. McCarty
Chair
Aerospace Safety Advisory Panel

2 Enclosures:

1. Meeting Minutes
2. Attendance Log

Aerospace Safety Advisory Panel (ASAP)
Public Meeting Minutes
June 20, 2002
9:00 A.M. to 12:30 P.M.
Country Inn & Suites
Huntsville, Alabama

Introduction:

Prior to the opening of the public meeting, the Panel conducted a business session in which action item writing assignments were made. These may be found in Attachment 1. White papers, which address each of these actions will be drafted by the Panel per the assigned due dates. The issues which they address are in many cases quite complex and those which are due in the next month are attached to these minutes in order to comply with Federal Advisory Committee Act guidelines.

In the business session, the ASAP Executive Director, and Designated Federal Officer, Mr. David Lengyel suggested that the Panel consider reorganizing the team structure in order to consolidate functions, allow focus on key safety issues and ensure adequate coverage of emerging programs. A draft (re)organization chart may be found in Attachment 2.

Mr. Lengyel opened the public meeting of the ASAP at 9:00 A.M.. He reminded the public attendees that the Panel was a federal advisory committee to NASA and that the minutes to this meeting would be posted on the ASAP website within a month. Members of the public were asked to introduce themselves and state their affiliation.

ASAP Chair, Ms. Shirley McCarty also welcomed the public attendees and explained the general outline of the morning's agenda. Panel team leads were asked to comment on the NASA response to the ASAP CY '01 report, status of current fact-finding in CY '02 and issues which warranted additional fact finding in the coming months. The Panel's draft assessment of the NASA responses to the ASAP annual report, are found in Attachment 3 of these minutes.

Logistics Team: Mr. Bob Sieck stated that NASA and its contractors were adequately addressing current logistics, vendor and process control issues. The Logistics Team utilized several resources/metrics to backup this judgment, some of which were: United Space Alliance (USA) logistics reports and ATK-Thiokol reports and data presented at the annual suppliers conference and bi-annual Integrated Logistics Panel (ILP). Mr. McCartney, who attended the ILP conducted at the Michoud Assembly Facility in May 2002, stated that he was pleased with Ms. Joyce Rosewski's management of Shuttle logistics to date and that the Shuttle Program should benefit from consolidated leadership across elements. The Shuttle 2020 planning in the logistics area was a big step forward.

Mr. Sieck stated that the International Space Station Program logistics personnel also attend the ILP forum. He considered the ISS logistics support processes less mature than the Shuttle Program and that this was an area that the Panel should focus on at the plenary meetings to be held at the Johnson Space Center in October 2002. Mr. Sieck advised the Panel that they have an opportunity to accompany USA/NASA logistics personnel on supplier/vendor visits in the coming months with the first of these visits scheduled for 16-18 July at Collins-Rockwell and Hamilton-Standard.

Mr. Sieck recommended that the Logistics Team functions be absorbed within the Shuttle and ISS Teams versus being done as a standalone team. The Panel concurred and the appropriate changes will be made to the organization structure.

International Space Station Team: Mr. Sieck stated that real-time operations, assembly missions and standalone operations, were going well. He considered the number of in-flight anomalies experienced to date as expected for a system this complex. Mr. Sieck discussed the possible effects on quality and safety due to the ISS "reengineering" effort. Lengyel pointed out that the results of the Booz-Allen-Hamilton reengineering study would be presented to the Panel during a fact-finding visit to the Johnson Space Center in October 2002.

Mr. Sieck stated that another issue that the ISS team will be examining is overall ISS logistics support in the possible environment where the ISS is supported with four U.S. Shuttle flights per year and only three Russian Progress flights per year and what these constraints could have on dry cargo and reboost.

Mr. Sieck stated that several technical issues should be tracked by the Panel one of which was the Beta Gimbal Assembly anomaly. The Panel, he added, should look at the process of documenting and investigating inflight anomalies versus pursuing detailed briefings on the anomalies themselves. Dr. Leveson suggested that some of the anomalies might lead the Panel towards root causes stemming from engineering design problems. This in turn could assist the effort to examine leading indicators.

Ms. McCarty suggested that the ISS Team also examine crew sleep issues during the plenary at JSC in October 2002. Mr. Zygielbaum stated that the Panel should examine in more detail the U.S. – Russian safety organization interfaces and potential issues which might result from where the safety function is located in the different organization structures.

Shuttle Team: Mr. Englar briefed the Panel on the status of the SSP 2020 planning effort to date. He described the effort as under a very tight schedule and highly integrated with the plan to replace the Shuttle (i.e. 2nd Generation Reusable Launch Vehicle). The plan is for the Panel to continue to examine the process and prioritization tool associated with the 2020 planning effort. The Panel's interim assessment is provided as Attachment 4.

In addition to follow-up fact finding on issues called out in the CY '01 report, Mr. Englar suggested to the Panel that they consider: 1) conducting a splinter meeting with the

Orbiter Vehicle Office regarding the status (risk assessment/vendor/technical) of the Orbiter's Auxiliary Power Unit (APU) while at JSC in October, and 2) examining the lessons learned information system (LLIS) process as it relates to leading safety indicators and relevance.

Aerospace Technology Team: Mr. Schaufele briefed the Panel on the recent aerospace technology team activities to include examination of elements of the Agency's Aviation Safety Program. Dr. Leveson commented on the Small Aircraft Transportation Systems (SATS) program and the National Research Council (NRC) report on SATS which complemented NASA on technology development but criticized the program on the premise of customer demand for "cornfield to cornfield" flight operations. The NRC study suggested that NASA look at root safety issues they can solve in general aviation versus developing technology to backfit into a flawed concept of operations.

Mr. Schaufele stated that one member of the aero team would participate in the November 2002 functional peer review of JSC flight operations as part of the Panel's continued auditing of the IAOP safety processes.

The Panel's interim assessment of the ISS crew rescue options ranging from the Orbital Space Plane (OSP) utilization as a Crew Transfer and Return Vehicle (CTRV) to Soyuz-only operations to a "Safe Haven" concept is provided as Attachment 5. The safe haven option, if implemented, would open up an entirely new dimension of operations regarding mandatory crew return under emergency conditions.

Workforce Team: ADM Paul Reason discussed his review of the NASA strategic human capital plan. He described the Administration's human capital initiative, which spans the federal government's executive branch, and NASA's effort to comply with the Office of Management and Budget (OMB) guidance. He stated that NASA is off to a good start. The enterprise viewpoint expressed in the plan and the use of a modern tool to quantify Agency requirements to fit the right people with the right jobs in the right numbers to accomplish a given mission was commendable. Underpinning the study was a realization that the downsizing at NASA had generated an inappropriate skill mix and had incurred recruiting problems.

The Panel's assessment of the Strategic Human Capital Plan is provided as Attachment 6.

Ad Hoc Infrastructure Team: Mr. Forrest McCartney discussed the status of the action to examine the adequacy of NASA's process of making infrastructure decisions beginning with results of the telecon conducted with former Manager of Facilities Engineering, Mr. William Brubaker. Mr. McCartney believes that, pending further fact-finding, NASA understands the facilities issues well but that the Agency needs to step up and focus on the decaying safety aspects of their infrastructure. The Panel's assessment of NASA's infrastructure decision-making criteria is provided as Attachment 7.

Dr. Ulf Goranson stated that he had audited the Operations Engineering Board (OEB) process during a fact finding trip to the Dryden Flight Research Center. He discussed the

OEB charter, processes and summary outbrief to the DFRC Center Director. He suggested ASAP attendance at the next OEB scheduled to be conducted at the Michoud Assembly Facility (MAF).

Computer Hardware/Software Team: Mr. Art Zygielbaum discussed the prioritization of topics requiring fact-finding by the Computer Team which are summarized below:

Space Shuttle:
Cockpit Avionics Upgrade
- Redundancy philosophy
- Single mechanisms of failure
- Hazard analysis

Space Shuttle Main Engine (SSME) Advanced Health Monitoring System Phase 1
- Redundancy philosophy
- Impact on reliability
- Single mechanisms of failure

International Space Station:
ISS Command and Data Handling (C&DH) Architecture Improvements
ISS Multiplexer/Demultiplexer (MDM) CPU Utilization
Multi-Element Integration Testing (MEIT)
Thru Code Complete (Node 2)
Disposition of software problems
- Long-Term Plan
- Absence of Regression Testing
- New manager – intent and direction

Information Technology (IT) Security:
Penetration studies of ground systems
Access and penetration studies of flight elements
Payload command integrity and protection

Mr. Zygielbaum stated that differences in IT security practices had been observed during fact-finding visits to the Kennedy Space Center (KSC) and the MSFC. He stated that the Panel should determine whether NASA had an agency-wide, peer-reviewed set of IT security practices.

Astronaut Training Team: Mr. Sid Gutierrez discussed the potential impact of the NASA strategic resources review on the closure of crew training facilities. His team would examine this among other issues while at the Johnson Space Center in August 2002.

Mr. Gutierrez stated that in response to the action to evaluate the 2ndGenRLV risk management approach, his team believed that: 1) the right level of resources have been applied to the program for this effort, 2) the right techniques are being utilized, and 3) the overarching issue challenging the program is the definition of requirements. The Panel's full assessment is provided as Attachment 8.

Propulsion and Power Team: Mr. Otto Goetz discussed fact-finding conducted since October 2001 beginning with a fact-finding trip to ATK-Thiokol in Utah where the Propulsion Team witnessed an engineering test motor firing. In a follow-on ETM-2 debrief with MSFC and Thiokol personnel, the team learned that the reusable solid rocket motor (RSRM) still experiences nozzle throat pocketing and ply separation which need to be reported and tracked but that these were not safety of flight issues.

Mr. Goetz summarized his team's fact finding trips to Michoud Assembly Facility (MAF) and the Stennis Space Center (SSC) in May 2002. At MAF it was apparent that the External Tank (ET) Project is well managed by both NASA and Lockheed-Martin as evidenced by the briefings and facility tour. The plant was clean and in good condition and the workforce remains very motivated despite some layoffs. There were no problems to report as a result of the SSC visit.

Mr. Goetz stated that the ATK-Thiokol process failure modes and effects analysis (process FMEA) is tool which should be adopted by other NASA projects to prevent safety/quality incidents such as those discovered at Boeing-Rocketdyne in Canoga Park. With regards to the Space Shuttle Main Engine (SSME) Project, the hardware design is good but it is the people and processes that introduce problems into the system. Mr. Goetz attended an audit of Rocketdyne by a NASA team led by SSME Chief Engineer, Len Worlund. He stated that the team was formed to examine root cause issues associated with twenty-one quality incidents within the SSME Project since delivery of the Campbell Team SSME operations Report in 2001. The bottom line was that the incidents were caused by people, lack of attention to detail, inadequate process control, and not communicating "best practices" to the entire SSME workforce. These issues, combined with the Solid Rocket Booster (SRB) supplier problems might suggest that Defense Contract Management Agency (DCMA) quality audit processes are in need of review. From the NASA management side, there is a proper level of attention being given to the SSME issues but this is not as evident on the SRB Project where the lines of communication are somewhat confusing. Taken together, these issues should be factored into any decisions to make major changes towards Shuttle competitive sourcing.
The Panel's current assessment of NASA's Shuttle competitive sourcing study effort is provided as Attachment 9.

Navy Nuclear Submarine Benchmarking: RADM Walt Cantrell described the task given to the Panel by the Administrator regarding benchmarking the Navy nuclear submarine program. He stated that the formal fact-finding activity will start after Mr. O'Keefe signs out a letter to Secretary of the Navy to obtain Navy approval and support of visits to the appropriate Navy activities.

The Chair, Ms. McCarty closed the public meeting with a request to all participants to provide a notional list of top safety issues, which would be consolidated into a "top ten list" to be provided to the NASA Administrator at a future meeting. A telecon with the new Associate Administrator for the Office of Safety and Mission Assurance was recommended an addition to the fact-finding agenda for the year. The meeting was then adjourned.

Enclosure 2

Panel Members/Attendees:

RADM Walt Cantrell
Mr. Kenneth Englar
Mr. Otto Goetz
Dr. Ulf Goranson
Mr. Sid Gutierrez
Mr. David Lengyel
Dr. Nancy Leveson
Ms. Shirley McCarty
LtGen. Forrest McCartney
ADM Paul Reason
Mr. Roger Schaufele
Mr. Robert Sieck
Mr. Arthur Zygielbaum

Public Attendees:

Mr. Mike Pesen
Ms. Erin Richardson
Mr. Cray Sumner

CY ’02 ASAP Action Item Matrix

Title	Lead	Requirements	Completion Date	Status
Human Capital Plan Review/Comment	McCarty	Review/comment on Code F (HR) plan. Report findings to Code A/F.	A) Jun. 17 B) Jul. 1	Part A closed. Part B Open. Comments submitted to Code F 6/17. White paper to Code A in work.
2ndGenRLV Risk Management Assessment	Gutierrez	Review risk management approach for 2ndGen. Report findings/recs to Code A/B/M/R.	Jul. 15	Open. Conducted fact finding at MSFC 06/02. White paper for Codes A/B/M/R in work.
Shuttle Competitive Sourcing Safety & Risk Assessment	Goetz	Review safety aspects of RAND Study. Report findings/recs to Code A/B/M.	Jul. 15	Open. Conducted telecon with Sarsfield and Baker on 6/19 at MSFC. White paper for Codes A/B/M in work.
Shuttle 2020 Assessment	Englar	Assess 2020 options. Report to Code A. Report to Code A/B/M.	Jul. 15	Open. Telecon scheduled with SSP PM on 6/24. White paper for Codes A/B/M in work.
ISS Crew Escape Assessment	Schaufele	Assess R-STAR, vs. CRV vs. Soyuz vs. Safe Haven. Report to Code A/B/M/R.	Jul. 15	Open. CB White Paper sent to Panel. Conducted fact finding at MSFC 6/19. Telecon with JSC scheduled 7/09.
Infrastructure Assessment	McCartney	Assess infrastructure decision criteria and funding options. Report to Code A/Q/J/AM.	Aug. ‘02	Open. Telecon 6/21 with Mr. Hubbard, Code JX. Follow-on telecons in work.
Orbiter OMM Enhancements	Zygeilbaum	Assess OMM planning & implementation for possible safety improvements. Report to Code A/M.	Aug. ‘02	Open. Fact finding at KSC for 7/10 with SSP PM and KSC GO (including USA)

Navy Nuclear Sub IA	Cantrell & Reason	Benchmark Navy Nuclear SUBSAFE Program. Report to Code A/M.	Sept. ‘02	Open. Awaiting SecNav letter sign-off from Code A.
ISSP Reengineering Risk Assessment	Sieck	Assess reengineering effort for possible safety impacts. Report to Code A/M.	Oct. ‘02	Fact finding at JSC 09/02 on status of Booz-Allen-Hamilton blueprint and implementation plan.
ISS Logistics Assessment	Goranson	Assess logistics support to ISS under “visiting vehicle” constraints. Report to Code A/M.	Oct. ‘02	Open. Fact finding planned at JSC 09/02. Need to send data to Panel earlier.
Safety Leading Indicators	Leveson	Assess “Leading Indicators” across NASA. Goal is to improve data set. Report to Code A/Q.	Oct. ‘02	Open. Conducted fact finding at MSFC on 6/19. Other meetings are in work.

Attachment 2

Proposed Team Structure

1) Permanent Teams
    a. Aviation Safety
    b. ISS
    c. Shuttle
    d. SLI (2ndGenRLV and OSP)
    e. Workforce (astronauts, aircrew and occupational health and safety)
    f. Vehicle Processing & Ground Operations

2) Expertise
    a. EVA
    b. Astronaut/Aircrew Training
    c. Logistics
    d. Propulsion
    e. Computers/Software
    f. Human Factors

NASA Response to Annual Report for 2001

Summary

NASA responded on May 29, 2002, to the "Findings and Recommendations" from the Annual Report for 2001. NASA's response to each report item is categorized by the Panel as "open, continuing or closed." Open items are those on which the Panel differs with the NASA response in one or more respects. They are typically addressed by a new finding, recommendation, or observation in this report. Continuing items involve concerns that are an inherent part of NASA operations or have not progresses sufficiently to permit a final determination by the Panel. These will remain the focus of the Panel's activities during 2003. Items considered answered adequately are deemed closed.

Based on the Panel's review of the NASA response and the information gathered during the 2002 period, the status of the recommendations made in the Annual Report for 2001 is presented after each of NASA's responses.

Finding #1:

The current and proposed budgets are not sufficient to improve or even maintain the safety risk level of operating the Space Shuttle and ISS. Needed restorations and improvements cannot be accomplished under current budgets and spending priorities.,

Recommendation #1:

Make a comprehensive appraisal of the budget and spending needs for the Space Shuttle and ISS based on, at a minimum, retaining the current level of safety risk. This analysis should include a realistic assessment of workforce, flight systems, logistics, and infrastructure to safety support the Space Shuttle for the full operational life of the ISS.

Response:

Concur: Both Shuttle and ISS Program Operating Plans (POP) identify the total resource requirements necessary to retain and improve safety risk. The development of these plans involves assessments from all organizations and receives the highest level of NASA management review. NASA management maintains a safety first decision process and will continue to be vigilant in developing as much operating margin as possible. The Office of Space Flight has recently initiated an assessment to address space Shuttle fleet capability to fly safely until 2020. This assessment includes an analysis of workforce critical skills, flight systems upgrades, logistics and supportability, and any infrastructure upgrades requirements necessary to meet this goal. Any comprehensive assessment to support ISS beyond 2020 would occur in the future.

Status:

Continuing.

Finding #2:

Some upgrades not only reduce risk but also ensure that NASA's human space flight vehicles have sufficient assets for their entire service lives.

Recommendation #2a:

Make every attempt to retain upgrades that improve safety and reliability, and provide sufficient assets to sustain human space flight programs.

Recommendation #2b:

If upgrades are deferred or eliminated, analyze logistics needs for the entire projected life of the Space Shuttle and ISS, and adopt a realistic program for acquiring and supporting sufficient numbers of suitable components.

Response:

Concur 2a: NASA and its contractors have continued to maintain and improve on the excellent safety practices and processes and as such, safety has not been compromised. Comprehensive analyses have identified potential upgrades projects that can further reduce risk if fully funded. Examples of needed long-term supportability upgrades that are not currently funded include the Orbiter's communication and tracking system, components of the Orbiter's data handling system, and the SRB avionics subsystem. Every attempt is being made to apply available resources to the more promising areas of improvement.

Concur 2b: Long-term supportability analysis continues on a periodic basis between Orbiter, Logistics, and SMA. Most recent orbiter/logistics summit updated the supportability issues list in November 2001. SSP hardware element managers and SSP logistics managers have implemented a continuing supportability assessment analysis which is intended to maintain cognizance of potential supportability issues and to develop mitigation actions.

Status:

The Panel considers the response to 2a as satisfactory and can be considered *closed*. 2b is considered *continuing*.

Finding #3:

Much of the Space Shuttle ground infrastructure has deteriorated and will not be capable of supporting the Space Shuttle for its realistic service life.

Recommendation 3:

Revitalize safety-critical infrastructure as expeditiously as possible.,

Response:

Concur 3: Human space flight is greatly dependent upon a capable ground infrastructure. The ISS and SSP management have worked closely with Center Directors in identifying the facilities, GSE, training, and test equipment necessary to continue and improve human space flight. As funding becomes available, it is applied to those areas having the greatest risk benefit.

Status:

Continuing.

Finding #4:

NASA is considering closing or deactivating some training and test facilities in an effort to economize.,

Recommendation #4:

Perform a detailed full life cycle safety and needs analysis including consideration of critical skills retention before making closure decisions.

Response:

Concur 4: Any consideration for training or test facility closure will be based upon an appropriate risk assessment that considers their significance to the readiness level of the crews or the vehicle.

Status:

Continuing.

Finding #5:

Space Shuttle privatization can have safety implications as well as affecting costs.,

Recommendation #5:

Include in all privatization plans an assessment by safety professionals of the ability of the approach to retain a reasonable level of NASA technical involvement and independent checks and balances.

Response:

Concur 5: All privatization discussions to date have included direct participation by the NASA Headquarters, Center, and SSP Safety organizations. A fundamental ground rule of any privatization option is that it must include the proper checks and balances as well as healthy tension between design and operations and include a value added independent assessment process. Current plans include numerous independent reviews of privatization concepts that will be structured to include safety professionals.

Status:

Continuing.

Finding #6:

The safety of NASA's human space flight programs will always be dependent on the availability of a skilled, experienced, and motivated workforce.

Recommendation #6:

Accelerate efforts to ensure the availability of critical skills and to utilize and capture the experience of the current workforce.

Response:

Concur 6: Capturing the experience of the current workforce by continuing to hire and train young engineers is vital to the long-term safety of the Space Shuttle Program (SSP). NASA, USA, and the State of Florida have developed the Aerospace Technician Certification program, which provides a 2-year curriculum (4-year program in development) towards a space quality standard. Similar certification programs are in work for other aspects of SSP work. A Mentoring Program, focused on further development of technical and managerial skills, is also in place. The Prime Contractors have various hiring, training, and mentoring programs to facilitate skill development and retention. The International Space Station (ISS) is early in the operational phase and has sufficient NASA civil service personnel to assist in the training and mentoring of new Boeing engineers. Further documentation is readily available on key subsystems and some hardware is still being procured. This will also allow an opportunity for new Boeing engineers to learn ISS systems in detail. In summary, this is an excellent time in the ISS program history to transfer and train new personnel and set in place a lower sustaining cost structure.

Status:

Continuing.

Finding #7:

Mishaps involving NASA assets are typically classified only by the actual dollar losses or injury severity caused by the event.

Recommendation #7:

Consider implementing a system in which all mishaps, regardless of actual loss or injury, are assessed by a standing panel of accident investigation specialists. The panel would have the authority to elevate the classification level of any mishap based on its potential for harm.

Response:

Concur 7: NASA NPD 8621.1G defines a mishap as any unplanned occurrence or event resulting from any NASA operation or NASA equipment anomaly. Current human space flight problem reporting systems require reporting and analysis of all operational or equipment anomalies against criteria that includes addressing the potential for significant loss of life or assets. At this level, the investigative experts are the engineers, managers, and maintainers of the equipment.

If an actual mishap were to occur, the Mishap Investigation Team (MIT) would be the first response. All members of this team have had accident investigation training and the Chairman has completed the NTSB accident investigation school and USC Aviation Safety curriculums.

Status:

Closed.

Finding #8:

There is no requirement for MIBs to include individuals specifically trained in accident investigation and human factors.,

Recommendation #8:

Adopt a requirement for the inclusion of accident investigation and human factors expertise on MIBs.

Response:

Concur 8: NPD 8621.1G states that it is NASA's policy to conduct NASA mishap investigations, using NASA MIB's, with properly trained personnel. At the Space Shuttle Program level, this has been implemented through the assignment of the Mishap Investigation Team. All members of this team have had accident investigation training and the Chairman has completed the NTSB accident investigation school and USC Aviation Safety curriculums.

Status:

Closed.

Finding #9:

The first increment of the CAU has significant potential for long-term Space Shuttle risk reduction and provides a platform for still further improvements.

Recommendation #9:

Maintain the previously planned funding to expeditiously implement the CAU.

Response:

Concur 9: CAU is currently adequately funded and authorized through PDR. Due to budget pressures NASA has reduced CAU funding to include only CAU Increment 1, which does provide key safety improvements. Increment 2 will be implemented on a deferred schedule using available sustaining engineering resources.

Status:

Closed.

Finding #10:

Orbiter wiring inspections have shown instances where redundant wiring is carried in the same wire bundle.

Recommendation #10:

Expedite efforts to route redundant wires in separate wire runs.,

Response:

Concur 10: Orbiter project is currently expediting the separation of redundant wires. All that can be accomplished during a normal flow at KSC are being scheduled and those that cannot will be implemented during the vehicles next modification period.

Status:

Closed.

Finding #11:

Little definitive action has been taken to correct and preclude continuing the undesirable situation of excessive unincorporated EOs in the orbiter engineering drawings.,

Recommendation #11:

Expeditiously reduce the number of the drawing changes currently outstanding.,

Response:

Concur 11: Orbiter project is currently working to reduce the number of outstanding drawing changes. The project is prioritizing the drawing updates based on criticality, complexity, and traffic. The highest priority tile drawings have been completed and other subsystems will follow.

Status:

Continuing.

Finding #12:

Space Shuttle logistics will face increasing challenges from vendor issues including closures, mergers, relocations, and changes in capability.

Recommendation 12:

Continue to emphasize to all suppliers the importance of timely reporting of all significant business and organizational changes that could affect Space Shuttle logistics.

Response:

Concur 12: The Space Shuttle Process Control Working Group has been instrumental in communicating to the contractors and suppliers the importance of change control and notification. The Logistics departments continue to interact with the suppliers on a daily basis and have had good success with suppliers providing notification of changes. Several supplier conferences have been held at the Project level to reinforce this message. On January 23–24, 2002, the SSP held its first Program-wide supplier conference in which this theme was communicated and reinforced by top management.

Status:

Closed.

Finding #13:

Deferring the OMMs intensifies the risk that scheduled safety upgrades will never be completed, thereby further increasing the life cycle safety risk of operating the Space Shuttle.

Recommendation #13:

Incorporate deferred safety-related modifications in the affected orbiters expeditiously. This should not be accomplished at the expense of other safety or operational upgrades, or the prudent maintenance of the Space Shuttle system and its infrastructure.

Response:

Concur 13: Orbiter project is currently incorporating a number of safety-related modifications and has placed priority on many proposed safety and risk reduction modifications.

Status:

Closed.

Finding #14:

It is reasonable to utilize the same engineering and technician workforce for routine Space Shuttle processing and OMDP work at KSC, since the work content is similar. Planning and management functions, however, differ significantly between line processing and heavy maintenance activities.

Recommendation 14:

Designate separate, appropriately experienced management teams for the regular processing and OMDP work at KSC. These teams must be well-coordinated, since they will be drawing on the same workforce.

Response:

Concur 14: The Orbiter Project has established an OMDP Management Plan, which designates a separate Orbiter management team for OMDP.

Status:

Closed.

Finding #15:

While the basic framework for system engineering of damage detection, assessment, and control has been established, work remains to be accomplished to reduce vulnerability to the hazards of fire and pressure leaks.

Recommendation 15a:

Examine procedures, tools, and instrumentation to locate fires and penetrations more rapidly, especially those occurring behind equipment racks.

Recommendation 15b:

Improve the ability of the crew to communicate with each other while dealing with emergencies.

Recommendation 15c:

Create, qualify, and stock kits for rapid short- and long-term repair of penetrations.

Recommendation 15d:

Develop a procedure to be used in the event of combined depressurization and fire.

Response:

Concur 15a: A prototype, hand held, Ultra Sonic leak detector has been deployed to ISS for evaluation. This detector allows more rapid identification of leaks in pressurized elements. It has been utilized on-orbit to locate minor leaks in components.

Concur 15b: A wireless intercom headset has been proposed. Implementation of this capability will be evaluated as part of the Pre-Planned Program Improvement (P3I) Process.

Concur 15c: The three-phased development plan of joint U.S. and Russian Leak Detection and Repair Team includes both short-term and long-term repair of penetrations.

Concur 15d: NASA will evaluate the adequacy of current fire and depressurization procedures to handle a combined fire and depressurization event.

Status:

Continuing.

Finding #16:

There is no visual or aural indication to the crew that safety-related alerts have been inhibited.

Recommendation #16a:

Develop an appropriate alerting system to remind the crew that C&W functions have been inhibited and/or to enable the crew to limit the inhibit to only a specific period.

Recommendation #16b:

Avoid the need to inhibit C&W alerts by countering the root causes of false alarms whenever possible.

Response:

Concur 16a: The C&W SIT will address this condition and bring recommendations forward to the Program for disposition.

Concur 16b: The Caution and Warning System Integration Team (CWSIT) considers eliminating false alarms as a primary objective for planned Caution and Warning System improvements.

Status:

Continuing.

Finding #17:

With the decision to scale back the production contract for CRVs, the ISS must operate for the foreseeable future with a crew limited to three.

Recommendation #17a:

Continue the flight test program for the X-38 and proceed to the space test of the V201 prototype.

Recommendation #17b:

Press to restore the CRV production program or find a substitute rescue vehicle approach to permit expansion of the ISS crew.

Response:

Non-concur 17: NASA has developed a plan for an orderly shutdown of the X-38/Crew Return Vehicle (CRV) Project. After reconsideration of ISS requirements, NASA's strategic needs, alternative capabilities, and developmental challenges, NASA now considers that pursuit of a single purpose/application vehicle of this investment magnitude is not the best use of NASA resources. Rather, NASA's objective will be to consolidate multiple objectives (crew return, crew transfer, etc.) and to mold them into a more efficient approach providing a vehicle with much more robust capability and a wider range of potential applications. As such, CRV requirements are being incorporated into Crew Transfer Vehicle trade studies as a part of NASA's Strategic Launch Initiative (SLI) Program; lessons and technologies learned from X-38 will provide value to multipurpose vehicle concepts or other NASA programs.

The termination plan provides for orderly closeout of X-38 activities so as to preserve established value for potential SLI technology demonstration purposes. The orderly closeout requires select ongoing activities to be phased out to logical endpoints by the end of 2003. The plan includes delivery of components from vendors under contract, those currently in-work in NASA shops, and those to be provided through international cooperative agreements with integration and testing as required. Efforts associated with additional lifting body flights, flights of components on test aircraft, and X-38/CRV-related parafoil flights will be terminated, and CRV procurement will be officially cancelled. The current funding for X-38 is consistent with funding requirements for the closeout plan. Relative to ISS, the Russian Soyuz currently provides the emergency crew return function. Should research requirements result in a decision to increase crew size, the Russian Soyuz is the only vehicle capable of providing emergency egress in the timeframe of completing the ISS "Core" configuration. This would be the case, even if the U.S. CRV effort were to be fully restored.

Status:

Continuing.

Finding #18:

Funding cuts threaten to eliminate all effort on maintaining and updating surveillance and modeling of the orbital debris population as early as October 2002.

Recommendation #18:

Reexamine the decision to eliminate this important function and assure that the core MMOD effort is continued.

Response:

Concur 18: Office of Space Flight is seeking to identify all users/stakeholders of the current Orbital Debris Program and identify appropriate program content and long-term Agency funding source(s) to assure NASA retains capability for compliance with Agency Orbital Debris Policy for NASA missions.

Status:

Closed.

Finding #19:

The terrorist attacks on September 11 emphasized the need for increased security of all national assets, including NASA's computer systems. Since many of these systems safeguard the lives of astronauts and cosmonauts and the safety of valuable international assets, it is crucial that security vulnerabilities be fully understood and closely managed.

Recommendation #19a:

Accelerate the schedule of penetration exercises to gain greater insights into computer security vulnerabilities; determine if further threat analysis should be conducted; review all vulnerabilities; and ensure that plans are adequately formulated to mitigate these vulnerabilities and that work is proceeding to prevent critical systems from being compromised.

Recommendation #19b:

Accelerate the schedule for the implementation of triple DES.

Response:

Concur 19a: The Agency and Center IT security program is a risk-based management and acceptance process. The program continues to evolve to incorporate and facilitate tools and metrics for greater insight into security vulnerabilities. Currently the Centers perform quarterly vulnerability scans and metrics that are reported to the Agency. The vulnerabilities found are reviewed and worked through a defined process. Mission Critical systems external interfaces such as those of the JSC Mission Control Center with the JSC Institutional Network are included in these quarterly assessments. We will continue to work to improve this process and capability as new technologies and tools become available.

Concur 19b: The change to incorporate the triple DES has been negotiated with the contractor; a probabilistic risk assessment associated with losing S-band communications is being conducted prior to Program implementation.

Status:

Cosed.

Finding #20:

The C&DH system is vulnerable to instability under heavy load conditions. This problem is currently handled by procedurally controlling processing activities.

Recommendation #20a:

Gain an improved understanding of the range of commanding problems that lead to constraints on the system. Issue additional Problem Reports (PRs) as appropriate.

Recommendation #20b:

Process outstanding PRs.

Recommendation #20c:

Evaluate potential architectures that would improve system stability and robustness and ensure safe operations. Implement architecture improvements as soon as it is prudent to do so.,

Response:

Concur 20a: Believe this has already been accomplished as part of the standard design and development activities.

Concur 20b: Due to the large amount of ISS SW code being developed and in use, there is an imposing amount of Problem Report traffic. The backlog varies based on the amount of testing in progress at any one time. Considerable emphasis is being placed on reduction of the backlog and a dedicated team has been instituted as a part of the I&O contract to focus solely on PR resolution. Results to date indicate that even though the total backlog varies up and down relative to current activities, the average age of the open PRs is decreasing.

Concur 20c: Preliminary work has already been done to identify improvement areas. As Pre-Planned Product Improvement funding becomes available, we will move forward to implement any appropriate enhancements.

Status:

Parts a and b closed. Part c continuing.

Attachment 4

Space Shuttle Options to 2020

In our annual report of 2001, the Aerospace Safety Advisory Panel recommended that NASA extend the planning horizon for the Shuttle to the year 2020, since a flight proven replacement was not likely to be available prior to that time. At the ASAP annual meeting in March, 2002, NASA Administrator, Mr. Sean O'Keefe, asked the Panel to consider NASA options to safely operate the Space Shuttle for 10, 15, and 20 years. On 25 March, Code M AA, Mr. Fred Gregory, directed the SSP to develop a strategy to identify upgrades and supportability investments required to maintain the Shuttle fleet capability to fly safely through 2020.

In response, the SSP Program Manager, Mr. Ron Dittemore, has set up a three level team structure for this activity: an Executive Committee to give policy and strategic direction and a Core Leadership Team, led by Mr. Lee Norbraten, to evaluate and prioritize the initiatives proposed by the third level Project Support Team, which consists of representatives of the major Shuttle contractors and the Shuttle elements at several NASA Centers.

Contrary to prior upgrade studies, the teams will look not only at safety, but also at supportability factors such as sustaining personnel, infrastructure, availability of logistics, and the suppliers. System design, hardware/software reliability, facility infrastructure, and personnel skills are to be addressed. A "business case" is to be prepared for each initiative proposed, including technical description, cost, existing risk reduction expected, risk of the new initiative, and schedule data. It was readily recognized that these data will be sketchy at best in the short time available.

Five factors of importance have been selected for evaluating suggested initiatives:

- Safety of flight; i.e., hazard abatement
- Asset assurance: skills, infrastructure, etc.
- Performance capability
- Ease of implementation
- Cost savings

The schedule for this planning is very tight, driven by the need to present FY 2003/2004 budget data to the Administrator on 1 August 2002. The interim schedule goals are:

16 July: Review preliminary prioritization of initiatives proposed.

30 July: Develop decision package for HQ review

This clearly is a work in progress, with no conclusions at this time. However, the process that has been set up and the tools that are being developed to evaluate options are both excellent and should put the Agency in a position to make prudent decisions.

Attachment 5

ISS Crew Escape Options Interim Report

Background During the Space Station Freedom design studies, the need for an Assured Crew Return Vehicle (ACRV) was recognized, based on three types of circumstances that require emergency evacuation by some or all of the crew. These are: 1. a medical emergency; 2. an accident which renders the station uninhabitable; and 3. inability to resupply the station. An independent review of the justification and mission requirements for the ACRV was performed by the Aerospace Safety Advisory Panel (ASAP) in 1992. The review concluded that the development of the ACRV system was justified, the defined missions were appropriate, and that two vehicles, each with the capability of evacuating the full crew of the station were required. Industry estimates were about $2 billion for the design, development, testing and production of four vehicles. NASA then instituted an in-house effort, called the X38/CRV project, to develop the technology and define a vehicle to meet the crew escape design missions for considerably less cost than the standard industry approach. The target date for the availability of the CRV was at the completion of the ISS assembly in 2006. During the assembly phase of ISS, the crew size is limited to three, and the crew escape requirements are being met with a single Soyuz vehicle. Later studies of the crew escape requirements from ISS supported the need for two return vehicles, but concluded that the operational requirements could be met with one seven person CRV and one Soyuz vehicle. A still later study focused on the probabilities of the circumstances outlined in the design reference missions, and evaluated the "safe haven" concept for risk mitigation. Conclusions were that the most probable need will be for a medical evacuation, several times during the life of the ISS, and that safe haven does not cover the medical evacuation scenario. Because of budget pressures, the NASA X38/CRV project is being shut down, and new studies on crew return options are being conducted as part of the Space Launch Initiative (SLI) Program.

Current Study The SLI study is focused on providing NASA with a set of options and a recommended solution for the best way to satisfy both the ISS crew rescue requirements and the SLI crew delivery and return requirements. The options are being evaluated in terms of funding priorities, technical risk, and schedule requirements for full crew rescue from ISS. The options include: additional Soyuz vehicles, qualification and use of X38/CRV V201 as a four person rescue vehicle, development and use of X38/CRV V301 as a seven person rescue vehicle, and design and development of an interim seven person CRV for the ISS, based on the final dual purpose CTRV for use with the 2nd Generation Reusable Launch Vehicle.

Observations At this point, it appears that the addition of another Soyuz vehicle to the ISS for crew escape is the quickest and most cost effective way to increase the crew size on the ISS to six with a technical risk level nearly the same as exists today. Other options involving the development of new vehicles for seven person crew escape from ISS are very expensive ($8-$10 billion), are subject to significant technical risk, and would involve a long (8-10 yr) design, development and test program before a qualified CTRV would be available. It may be that the only affordable option is the addition of another Soyuz vehicle, and limiting the crew size to six for the foreseeable future.

Attachment 6

ASAP Strategic Human Capital White Paper

Background: The Panel was asked to review the NASA Strategic Human Capital Plan (SHCP) and to compare and contrast it with models established by the National Academy of Public Administration's Human Capital Plan (NAPA HCP) and the U.S. Navy's Human Capital Plan (USN HCP). In mid-June, preliminary review comments were provided to Code F.

Plan Review: The objective of the SHCP is to engender the changes required to achieve "green" OMB ratings, which it will accomplish. A bolder objective would be to transform the Agency to realize the goal of "One NASA". An objective that encompasses this change would be more in consonance with the sea change designed for the USN HCP, which sets about to play a pivotal role in totally reformulating the culture of the Navy and the Marine Corps.

The USN HCP uses a full generation for its planning period. ASAP believes that this is too ambitious for the SHCP. Because enabling technologies cannot be extrapolated for more than ten years with much accuracy, the Panel believes that a decade would be an appropriate period. The NAPA HCP discusses a five-year time horizon, which is short for culture change.

The skills gap is a multi-headed Hydra with which all strategic planners must be prepared to do battle. As the Baby Boomers look longingly at retirement, and as the Baby Busters grow more reluctant to embrace the rigors of an engineering or science education, NASA and its contractors will face skills gaps that resemble yawning chasms. Quantification is a giant step in dealing with skills gaps. Of pivotal importance to the success of the SHCP is a comprehensive data base initiative that includes standardized position descriptions for every job needed in NASA today and anticipated for future success. (The NAPA HCP is very specific about tactics for grappling with skills gaps; whereas, the USN HCP provides less detail on this subject.)

There is little discussion in the SHCP about how HR will change during the planning period as it endeavors to transform the culture of the Agency. As a result of declining costs of computer hardware, storage, and sophisticated HR software systems, it will be possible to automate most of the labor-intensive, record-keeping work in HR. And terabits of light dancing down shining skeins of glass are clearly disaggregative, freeing HR professionals with human dynamics and leadership skills to make more direct contributions to the enterprises. By applying their skills, they can help to lead change and to assist in developing more agile, effective organizations throughout the Agency. The Plan should develop this aspect of the transition. (USN HCP was very strong on this aspect of developing human capital, while the NAPA HCP was less so.)

Missing from the SHCP strategies to shift NASA's culture to one of learning, performance, and leadership are initiatives to describe, communicate, and reward model behaviors that will achieve these culture changes. Without a road map, employees will struggle to know what these mean to them. (The USN HCP covers this well; the NAPA HCP does not.)

Recommendation: The Panel recommends that strong, unrelenting pressure to improve safety and to enhance the quality of work life for NASA's most valuable resource—its human capital—be the objective and the focus during the implementation of cultural change at the Agency.

Attachment 7

Whitepaper on NASA Infrastructure Management

Purpose:

To respond to the tasking by the Administrator during the annual ASAP meeting in March 2002 to: 1) evaluate the management and funding process of infrastructures within NASA and 2) explore innovative funding sources of the infrastructure. This is an interim report regarding the first task.

Facts/Observations:

Funds are not available to significantly reduce the stated Backlog of Maintenance and Repair (BMAR) or to construct all proposed new/replacement facilities. The growing BMAR is increasing the risk to safe and reliable operations.

Maintenance and Repair work is selected by the use of decision tools such as Risk Assessment Codes (RAC) and Reliability Centered Maintenance (RCM). No significant injury or incident has occurred using this approach. Subjective judgment is used to determine when the risk of continuing operations is too high.

A deferred maintenance study to provide an auditable and consistent measurement of facility condition has been initiated. Additionally, a Critical Facilities Maintenance Assessment (CFMA) has been proposed for equipment. Base lining the actual condition of facilities and equipment is fundamental to determining the risk of operation. Also a Agency wide utilization study has been initiated to identify excess property. These studies are scheduled to be completed by the end of 2002.

The proposed shift to "landlord-tenant" funding will provide an improved ability to manage facilities and to assign responsibilities and accountability. If the "landlord" is clearly responsible for providing safe and reliable facilities and equipment, he/she will include the cost in the "rent". If the BMAR is valid, the costs for the landlord to restore facilities and equipment to the proper safety level may exceed the tenant's ability to pay "rent". To remain affordable and competitive, the landlord may be forced to consolidate, reduce footprints, demolish or take other actions to help finance needed maintenance from funds other than "rent". Therein lies an incentive to find a way to achieve the required maintenance of facilities. Additionally, the concept requires NASA establish a consistent process for determining facility condition and utilization. Each landlord must have the same standard.

The need to address the issues of infrastructure size and condition, including responsibilities, accountability, funding, consistent metrics and standards and risk status, has been recognized by senior NASA management. The creation of the Enterprise Council (with the accompanying Executive and Institutional Committees) combined with changes in budget processes/financial accountability and program objectives hold the potential for increased effectiveness and efficiencies of infrastructure management. It is too early to asses these recent changes. During this transition time period, continued focus on safe and reliable operations of exiting facilities is mandatory.

Attachment 8

Space Launch Initiative (SLI)/2nd Generation Reusable Launch Vehicle (2ndGen RLV) Risk Management Assessment

Background: The SLI Program has instituted an integrated risk management approach, which will be implemented across all segments of the Program. The Program Risk Management Plan defines a continuous, disciplined, decision-making process to identify, analyze, plan, track, control, communicate and document risk. The Program and all projects will seek to actively identify and treat risk.

Review: The Aerospace Safety Advisory Panel (ASAP) reviewed the SLI integrated risk management program. This included the review of appropriate documents as well as presentations from and discussions with management, technical, and Safety and Mission Assurance (S&MA) personnel. The plan is continuous across the program including contractors. It uses standard, accepted tools and is well staffed with qualified personnel. The program should produce standardized, valid results that can be used to make comparisons among competing designs and against the current system. While developing the plan, the program office identified significant differences between results calculated by the government and the figures produced by some of the contractors. The differences were traced to the assumptions used by each team. These assumptions have now been standardized.

Observations:

· Current assessments of proposed designs indicate that a probability of loss of crew of one in 5,000 may be achievable. The original program goal of one in 10,000 is probably unrealistic for a Second Generation RLV, given current schedules and budget.

· The most significant obstacle encountered in this effort is the lack of validated requirements. With both Code M and Code R influencing requirements definition within NASA and both the Air Force and commercial industry affecting them from outside, the program will need help from NASA Headquarters to define requirements early and then avoid creep.

· One requirement driving the design and associated risk is the up mass. The up mass requirement sizes most of the design and is therefore the largest cost driver. The current "work to" up mass is suspiciously close to the original shuttle requirement. This requirement should be challenged with "out-of-the-box" thinking to ensure it is as low as possible.

· The current schedule to reach Preliminary Design Review (PDR) is tight technically. Any negative programmatic effects on this schedule will be likely to result in a slip to PDR.

· Additional risk is present because both the government and contractor teams are relatively inexperienced with a program of this size. This is unavoidable since it has been so long since the country undertook a spacecraft vehicle development program of this magnitude.

· In reviewing the current risk data for the competing designs, it is obvious that most of the reduction in risk to the crew comes from a full-envelope crew escape system. If the objective of the SLI program is to reduce risk, then the Second Generation RLV should be compared to the Shuttle equipped with a full-envelope crew escape system. Comparisons should include cost, schedule, and safety risk.

· The current baseline is a fully autonomous vehicle that does not have any crew interactions. For this reason, the flight reliability and safety parameters do not address human reliability and human factors.

Recommendation: To insure that NASA understands the improvement to risk resulting from a Second Generation RLV, the ASAP recommends that the designs that reach PDR should be assessed by an outside independent review team. Parameters assessed should include probability of loss of crew, loss of vehicle, and loss of mission. The NRC would be an appropriate organization to conduct this independent assessment.

Space Shuttle Competitive Sourcing
ASAP Safety and Risk Assessment

Background:
The idea of competitive outsourcing of the Space Shuttle dates back to the 1990s with the prime objectives to save costs, to get NASA out of operating an operational vehicle, and to invigorate the R&D element of NASA. Since 1994 several studies of Shuttle competitive sourcing have been performed and all stressed the importance of safety in human space flight and all stated resolutely that in the outsourcing process safety cannot be compromised. In its 2001 annual report the ASAP expressed concern that competitive sourcing could affect the safety of the Shuttle and recommended "*to retain a reasonable level of NASA technical involvement and independent checks and balances."* In its response NASA concurred with the recommendation.

Review:
During its plenary at MSFC on June 18, 2002, the ASAP received a briefing from the Space Shuttle Competitive Sourcing Task Force with Messrs. L. Sarsfield, Senior Fellow at the Rand Corporation and G. Baker, NASA Senior Advisor for Space Access, presenting. The briefing covered an overview of the Task Force activities, it listed the Shuttle functions performed today by civil service personnel, it listed the competitive sourcing options, but the briefing stopped short of making a definitive recommendation as to a preferred option. Implicit in the briefing, however, is the general recommendation that some competitive sourcing of the Space Shuttle or parts thereof should be executed. Portions of the identified functions are already outsourced with USA and other contractors, but as the report points out, NASA remains the controlling agent.

The stated safety goal of outsourcing is a) to maintain or even exceed the current level of safety and b) not to compromise safety at any time. The Shuttle operations and processes are inherently very complex with numerous critical items to prevent failure and loss of crew/vehicle. The energy packed and stored especially in the propulsion system can make even the smallest error unforgiving. Even though the processes are well documented, it is a known fact that not all corporate knowledge is and can be reflected in the manuals. The passing-on of this tacit knowledge is considered vital in the transfer of the operations from one performing entity to another. It is this knowledge transfer concern that the Panel considered when it made its 2001 recommendation to retain a core of highly qualified and experienced technical managers to oversee a complex program such as the Space Shuttle.

Conclusions and Recommendations:
1) The ASAP is not opposed to competitive outsourcing of Shuttle functions and operations. Concern exists in regard to the potential effect on the performance of critical personnel and in regard to the required transfer of knowledge and skill to maintain the necessary level of safety.
2) The ASAP is opposed to a complete NASA hands-off approach. NASA can not outsource responsibility and accountability and therefore must retain official involvement in safety. The Panel supports the Rand study proposal of an "Independent Safety Assurance Office (ISAO)."
3) To assure safe Shuttle flights and operations, the ASAP strongly recommends that NASA retain the technical authority for the design elements and processes which affect safe and reliable operations.