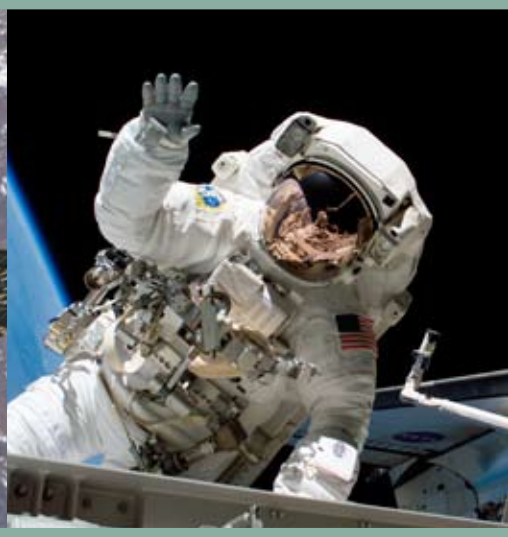

Aerospace Safety Advisory Panel

Annual Report for 2007

NASA AEROSPACE SAFETY ADVISORY PANEL
National Aeronautics and Space Administration
Washington, DC 20546
VADM Joseph W. Dyer, USN, (Ret.), Chair

July 7, 2008

The Honorable Michael Griffin
Administrator
National Aeronautics and Space Administration
Washington, DC 20546

Dear Dr. Griffin:

Pursuant to Section 106(b) of the National Aeronautics and Space Administration Authorization Act of 2005 (P.L. 109-155), the Aerospace Safety Advisory Panel (ASAP) is pleased to submit to NASA its 2007 Annual Report. The report acknowledges the significant progress made during this past year. At the same time, the Panel highlights opportunities for further improvement and the need to more quickly make progressive changes a part of the NASA culture.

As with so much that the ASAP undertakes, the cooperation of NASA's senior leadership and staff aided greatly in the completion of this document. Therefore, it is with both respect and appreciation that I submit our Annual Report for 2007.

Sincerely,

Joseph W. Dyer, VADM, USN (Ret.)
Chair
Aerospace Safety Advisory Panel

Enclosure

NASA AEROSPACE SAFETY ADVISORY PANEL
National Aeronautics and Space Administration
Washington, DC 20546
VADM Joseph W. Dyer USN, (Ret.), Chair

July 7, 2008

The Honorable Richard B. Cheney
President of the Senate
Washington, DC 20510

Dear Mr. President:

Pursuant to Section 106(b) of the National Aeronautics and Space Administration Authorization Act of 2005 (P.L. 109-155), the Aerospace Safety Advisory Panel (ASAP) is submitting to Congress its 2007 Annual Report.

The report documents the Panel's inquiries and analyses during that calendar year, all aimed at promoting the cause of safety throughout NASA. Through its efforts, the ASAP developed insights into aspects of NASA operations such as technical authority, workforce, safety culture, and risk management. In these and other areas, the ASAP recognized NASA's safety achievements in 2007, but the Panel also identified further, vital measures that are needed to ensure the Agency's continued commitment to the highest safety standards. As detailed in the enclosed report, it is a particular challenge to maintain those standards in this time of program transition and budget constraints.

I would be pleased to discuss the contents of this report at your convenience.

Sincerely,

Joseph W. Dyer, VADM, USN (Ret.)
Chair
Aerospace Safety Advisory Panel

Enclosure

NASA AEROSPACE SAFETY ADVISORY PANEL
National Aeronautics and Space Administration
Washington, DC 20546
VADM Joseph W. Dyer USN, (Ret.), Chair

July 7, 2008

The Honorable Nancy Pelosi
Speaker of the House of Representatives
Washington, DC 20510

Dear Madam Speaker:

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Sincerely,

Joseph W. Dyer, VADM, USN (Ret.)
Chair
Aerospace Safety Advisory Panel

Enclosure

"The Panel shall review safety studies and operations plans referred to it, including evaluating NASA's compliance with the return-to-flight and continue-to-fly recommendations of the Columbia Accident Investigation Board, and shall make reports thereon, shall advise the Administrator and the Congress with respect to the hazards of proposed operations with respect to the adequacy of proposed or existing safety standards, and with respect to management and culture related to safety. The Panel shall also perform such other duties as the Administrator may request."

—Section 106(b) of the National Aeronautics and Space Administration Authorization Act of 2005 | Public Law 109-155, 42 U.S.C. 16601

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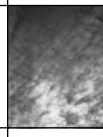


I. Executive Summary

In 2007, the Aerospace Safety Advisory Panel (ASAP) confirmed substantial progress that NASA has achieved in dealing with a variety of longstanding safety problems. But over the same year, other concerns have emerged or intensified, in the ASAP's estimation. Taken together, these concerns suggest a lack of consensus within NASA about the Agency's vision and direction. In the Panel's view, NASA could benefit from a dialogue that would be thorough enough to provide clarity of purpose.

The ASAP poses these questions:

It appears to the panel that some programmatic decision timelines are leaping ahead of availability of the data on which the decisions should be based. This may be a reaction to a NASA leadership style at some times in the past, when decision making was viewed as too slow and laborious. But has the pendulum now swung too far, such that programs have been instituted so precipitously that their objectives are not firmly established before the program is initiated?

Is mission driving requirements, rather than the other way around?

Could these developments have an impact on safety performance within the Agency?

Panel members have found surprising anxiety among NASA employees associated with the Constellation Program. In program development, the early stages are usually marked by enthusiasm and optimism. If anxiety appears, it will most likely be toward the end of a program, when the hard realities of deadlines and resource limitations are paramount. If staff morale is at all diminished during this early phase in the lifespan of Constellation, that suggests to the ASAP that the rationale for the program may not be sufficiently understood or accepted within the organization. Constellation team members may be accepting top-level direction without fully understanding the purpose of what they are being directed to do. Furthermore, the Panel is concerned that the problem may not be limited to the Constellation Program.

The ASAP finds indications that NASA system planning, particularly as it affects overall safety performance, is deficient in clear-cut, appropriate requirements. As a result, a course correction is called for before this trend continues. But at the same time, a countervailing argument can be made that what NASA needs, more than ever, is continuity. The ASAP recognizes the numerous and varied advances that

have been achieved under the leadership of the current NASA Administrator, Dr. Michael Griffin. These improvements have resulted in significant safety gains for current NASA operations and safeguards for those that lie ahead. Among the recent advances is the reinstitution of the systems engineering process. The technical governance model was established, and there are efforts to institute it Agency-wide. NASA's program integration role was restored. By establishing the integration responsibility for Constellation within NASA itself, Dr. Griffin was demonstrating a vote of confidence in the technical expertise to be found within the Agency he directs.

The ASAP believes it is vital that progressive measures such as these be preserved, even as NASA and the Nation undergo a period of transition. During the coming year, the United States will elect a new President and a new Congress. That shift may result in new NASA leadership, or the current leadership may continue. NASA can and should be preparing now for the coming changes in governmental leadership—including, possibly, changes within the Agency. That means, among other things, finding ways to institutionalize and even extend the recent gains.

To both new Government leaders and those returning to office, as well as to members of NASA's own community, the ASAP offers a theme that it considers to be key to mission success, particularly safety, in all of NASA's endeavors: constancy of purpose. Even in a time of flux, the Agency's devotion to its core objectives must endure. The Panel does believe that there is apparent need for improvement, as outlined above, in NASA's planning and management direction. But at the same time, care must be taken to prevent dissipation of the improvements already achieved. In the tension between these seemingly conflicting prescriptions, constancy of purpose serves as the harmonizing principle. That purpose, in the broadest terms, is to expand humanity's presence in the universe. Yet constancy does not equate to inflexibility in achieving that purpose. As technological capabilities improve, NASA should always remain open to new kinds of systems to deploy and new means of exploration.

The ASAP continues to offer its counsel to NASA, but at this significant point in national affairs, the Panel will also seek to convey several views to the incoming Presidential administration and Congress. Among these are:

- The decision about NASA leadership needs to be made as quickly as possible.
- In the interest of safety in future manned missions, a timely determination is crucial for the direction of the Vision for Space Exploration.

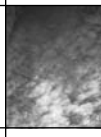
- NASA requires adequate funding to meet its commitments to space exploration and safety of flight.

Failure in these areas could undermine not only this country's commitment to a presence in space, but also U.S. National defense and global standing. With the Constellation Program and other initiatives, NASA has embarked on projects of long duration and great complexity. Safety and efficiency in such undertakings depend on continuity of leadership and appropriate funding. Without that support, the advances that NASA has achieved in recent years could be jeopardized, and to later regain what was lost would impose great and unnecessary risk and expense.

For its meetings with NASA staff, the ASAP requests as much specificity as possible in the information provided. The Panel also asks that the most well-informed NASA individuals participate in the ASAP reviews. In addition, when there are developments within NASA that have bearing on issues that the ASAP is chartered to scrutinize, the Panel requests that it be kept informed about those developments.

The Space Shuttle Program: In 2007 there were three Space Shuttle missions. All were successful in supporting and continuing the construction of the International Space Station (ISS). Yet two of the missions encountered operational difficulties before or during flight. Another mission, scheduled for 2007, was delayed by problems until 2008. These episodes reflect the inherent vulnerabilities in the Space Transportation System (STS), which decades of development, operational experience, and post-accident modification have been unable to eradicate completely. But these same mission results also provide a more encouraging narrative: the vulnerabilities may persist, but NASA has greatly improved the means to deal with them. In refreshing contrast to times past, discussions at mission-related meetings are open and vigorous, with dissenting views welcomed.

The ASAP has the statutory responsibility to monitor NASA's compliance with the 29 recommendations of the Columbia Accident Investigation Board (CAIB). Fifteen of those recommendations were designated "return to flight" (RTF)—indicating that they should be implemented before Space Shuttle flights resumed. As the CAIB was dissolved after publication of its final report, a separate independent body, the Return to Flight Task Group (RTF TG) was chartered to assess NASA's efforts to comply with the RTF recommendations. The RTF TG determined that NASA had met the intent of all but three of the RTF recommendations. These



dealt with: External Tank (ET) debris shedding; orbiter hardening; and Thermal Protection System (TPS) inspection and repair.

In 2005, the RTF TG completed its work and the ASAP began monitoring the ongoing NASA response to all the CAIB recommendations, particularly the three that remain outstanding. This response includes: modifications to the ET, aimed at minimizing the risk of foam debris liberation; measures to harden the orbiter against minor debris damage, such as thicker side cockpit windows; new imaging systems to inspect the orbiter's TPS; and TPS repair techniques for both Reinforced Carbon-Carbon (RCC) and tile. These efforts bear out the Shuttle Program's assertion that "We are moving forward with plans to ensure the continued safe operations of the Shuttle system throughout its service life." Furthermore, the ASAP is gratified that the Program continues to acknowledge the developmental nature of the Shuttle.

The issues inherent in these open recommendations represent enduring risks, and it is encouraging to see that NASA has not lost sight of those risks. But there is also what might be called an indirect risk in those issues—if they serve to distract attention from other potential danger areas. Even while doing everything feasible to correct the failings that led to the *Columbia* accident, NASA would do well to guard against such distraction from hazards unrelated to that accident.

The Constellation Program: The ASAP's concerns about unclear program objectives and requirements, as well as the possibility of lost continuity in NASA leadership, are likely to have the greatest bearing on the Constellation Program. The internal uncertainty about the purposes of this vehicle system is a function of the national debate that is still engaged over the Vision for Space Exploration. The ASAP urges not only NASA, but also the Federal authorities that oversee the Agency and the space policy experts that advise it, to strive more effectively for consensus on national priorities in space exploration. Among the many benefits of such a consensus will be a healthier Constellation Program, and consequently, a safer one.

While advocating for such improved future circumstances for Constellation, the ASAP continues to observe and comment on the program's current status. One longstanding problem for Constellation, one of the reasons that the ASAP believes the program lacks clear direction, lies in the design standards that have been established for it. The vehicle system under development is subject to human-rating requirements that are due to expire in 2010, but some portions are already out of date. Not only does an update have to be developed, but the organizational frame-

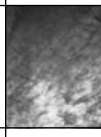
work for administering these requirements has also been going through extensive revision. The ASAP questions whether—even with updating and reorganization—the standards will be as rigorous and comprehensive as they should be.

The Panel stresses that "human rating" is a design process that should be integrated into the development of the equipment from its inception. Yet that has not always been the case with Constellation. Designs were being drawn up and contracts were being let for major program elements before NASA had a complete set of human-rating requirements, agreed to across the board. As with any major undertaking, it is likely to be cumbersome and expensive to commence a space program like this only to backtrack frequently for modifications, and the reliability of the ultimate results can also suffer.

In classic aerospace design, a vehicle is conceived and planned with redundancy and safety systems from the start, to ensure safety and reliability. If a component or system fails, one or more backups will be available to step in immediately. In the past, NASA vehicles have been designed according to these principles. But when the Orion Crew Exploration Vehicle was found to be exceeding allowable mass limits, a different approach was employed. In this "zero-base" approach, a minimal vehicle is designed, one that can accomplish the intended mission, but without all safeguards included. After that, additional safety features are incorporated into the design. But each such feature has to "earn its way in," through a demonstration that the safety benefit justifies the added mass and cost. The ASAP is concerned that this process may not be capable of providing adequate protection against hazards that will only come to light once the spacecraft is in operation.

When safety elements have to "earn their way" onto a design that has already begun to take shape, objectivity and consistency in the decision-making could be compromised. The inclusion of those elements could depend on the persuasiveness of the advocates making the argument that the proposed features are worth the added cost and weight penalty. The process can also be influenced by the perspectives of the individuals considering the argument. Vulnerabilities in the system can be compounded if the initial development budget is significantly constrained, as it is with Constellation.

In the development of Constellation, the ASAP does find that many of the Safety and Mission Assurance (SMA) functions are being performed in a very satisfactory manner. But one problem area may be program integration. NASA is undertaking



direct responsibility for integration, rather than relying on a contractor for that purpose, which was the case with the Shuttle Program. The ASAP believes this could turn out to be a very worthwhile course of action, provided that there is full understanding of how it is to work and the integration organization is adequately staffed. It appears, though, that such understanding does not yet extend among all those involved with Constellation. Improving the integration within Constellation should be one of the objectives for the Program Manager. For that reason, among others, the ASAP has urged that the Constellation Program Manager be given greater visibility, both within the Agency and to Congress and the public.

It may be that the Constellation vehicles will eventually transition to operational status. But at least initially, and for the foreseeable future, they should be recognized as developmental, providing all the safeguards associated with that designation.

The Shuttle-Ares Gap: The last Space Shuttle mission is scheduled for 2010. Under current Constellation Program plans, Ares I will be ready to transport crew members and cargo no earlier than 2015. That leaves a gap of at least five years in which the only means to service the International Space Station (ISS) will likely be via foreign spacecraft, primarily Russian. To address that gap, NASA is faced with several alternatives, all of them involving substantial risk:

- Extend the Shuttle Program
- Accelerate development of Ares
- Remain dependent on Russian vehicles
- Increase reliance on privately developed U.S. spacecraft, under the Commercial Orbital Transportation Service (COTS) Program

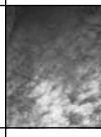
The ASAP asks: How much risk is attached to continued reliance on Russian spacecraft? Postponing retirement of the Shuttle would have costly effects. Given the age of the three remaining Orbiters, extending their service life would require elaborate reconditioning work. In order to maintain the level of safety and reliability to which the Shuttle Program has aspired from the start, all of that reconditioning work would have to be tested against rigorous standards. The expense in all this effort could draw heavily against Constellation if additional funding is not forthcoming. Furthermore, even a fully reconditioned Shuttle would still be subject to the risks inherent in its design.

Safety Performance in the Operation of NASA Aircraft: In recent years, the management of NASA's flight operations has been able to achieve an improved safety record, compared with earlier mishap rates—despite an aging aircraft fleet—and that trend was generally maintained in 2007. NASA's mishap profile is consistent with those of other Federal agencies. In its continuing effort to standardize aircraft operations and procedures across the agency, NASA aligned its aircraft operations program in 2007 with the standards of the General Services Administration's Interagency Committee for Aircraft Policy (ICAP). Also during 2007, the NASA Intercenter Aircraft Operations Panel (IAOP) made significant progress in its efforts to identify "best practices" within NASA aviation programs.

In 2007, after more than 10 years of significant aircraft modifications and program difficulties, NASA successfully flew its Stratospheric Observatory for Infrared Astronomy (SOFIA) aircraft, a Boeing 747SP, on its first test flight. SOFIA's successful flight tests and progress toward full operational capability demonstrate that the aircraft is being operated with the requisite level of safety.

Technical Authority: Based on its investigation of organizational shortcomings within NASA, the CAIB called for, among other corrective measures, the establishment of an "independent Technical Engineering Authority." Initially, NASA began to reorganize along the lines recommended by the CAIB. But Administrator Griffin called for some modifications to the remedy. He did separate the management paths for technical authority and safety. But he also instituted changes in those paths, with the Centers taking on greater control.

In 2006, the ASAP indicated its acceptance of this approach, but also its concern about the time that would have to be taken to implement it. In 2007, the ASAP did find evidence of successful integration, but not enough. The principles of technical authority seem to be well established at Headquarters, but at the Center level, the results are more mixed. The Panel remains concerned that implementation is still proceeding too slowly. If there is a change in NASA leadership, that implementation could be slowed further or even halted. That is another reason, therefore, that the ASAP encourages immediate transition planning to prepare for prospective changes in NASA leadership and congressional and White House oversight: to avoid interruption in adopting the valuable organizational enhancement that the technical governance model represents.



Resource Constraints: The ASAP has raised the question of whether NASA has sufficient resources not only to design and operate spacecraft and aircraft safely, but also to maintain its historic commitment to vital research promoting the safety of flight. At NASA Centers, the Panel has at times found indications of the current budget priorities: in order to pursue current space programs, primarily Constellation, aeronautical research must be cut back. At facilities that for years had been the sites of vigorous scientific inquiry, producing numerous advances in the safety of air travel, the flight lines are now under-utilized; many of the wind tunnels have been shut down.

The ASAP views it as essential for the exploration of space to continue. But the Panel does not believe that the aeronautical side of NASA's mandate should be sacrificed in the process. As safety advocates, Panel members believe it is their duty to speak up in the interests not only of those who fly into space or come in contact with spacecraft, but also of the millions who rely every day on the National Airspace System (NAS) to travel, often over long distances, without harm. Despite accelerating traffic demands on the NAS, the standards of air safety remain high—thanks in large measure to innovations developed or supported by NASA, such as advances in landing systems, air traffic management, airborne collision avoidance and safeguards against runway incursions. The diminished role of NASA in this field represents a loss to air safety progress, which is unlikely to be made up by other institutions. Furthermore, some of Constellation's preliminary challenges can be traced to resource handicaps. Ample early investment can often be crucial to ultimate program success.

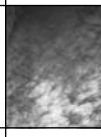
In light of this harmful impact of resource constraints on so much that NASA undertakes, the ASAP argues for a NASA budget sufficient to relieve those pressures. But the Panel also takes note of one factor that is exacerbating the situation for NASA. That is the financial burden of operating 10 Centers throughout the country. This is similar to the situation the Department of Defense experienced with excess capacity prior to establishment of the Base Realignment and Closure Commission. The ASAP appreciates the significance of each of the NASA Centers. If resources were not so limited, the Panel would support retaining all of them. But if doing that means spending so much on overhead that core elements of the NASA mission are compromised—including the commitment to safe operations and the ability to contribute to public safety—that strikes the Panel as too high a price.

Standardization in the Use of the Risk-Management Tool Set: The ASAP is a firm believer in standardization. When contradictory standards or differing procedures are present in the same enterprise, the likelihood of mishap is apt to increase. As the ASAP surveys the range of NASA enterprises, the Panel is struck by the profusion of definitions, design standards and process requirements it finds, including many that are in direct conflict with one another. NASA properly makes use of a variety of risk-management tools and presentations. This is one of the areas where greater standardization is needed. For example, the ASAP has advocated the adoption of a risk matrix that is more standardized than the broad assortment found among NASA programs today. The Panel is impressed with the approach developed for Constellation. Not only is there a matrix that displays risk levels and degrees of severity, but there is also a decision-making matrix to go with it, which defines the program authority at each point. The ASAP has recommended that NASA adopt this approach Agency-wide.

Manned Versus Unmanned Space Exploration: In 2005 and again in 2007, the ASAP issued recommendations calling on NASA to establish a formal review process of new mission proposals, to make sure that the most appropriate use is made of unmanned systems for some of the tasks in space exploration, to minimize risk to humans whenever possible. On land, sea and air, the roles for robotic systems grow steadily in number and sophistication. And those applications have long extended into space. NASA has made extensive use of unmanned spacecraft and rovers. But what is still missing is the kind of review process described in the ASAP recommendations. NASA needs a systematic method to analyze the risks, costs, and other considerations in assigning missions to its human and nonhuman explorers.

Safety Program Management: The ASAP continues to examine the Safety and Mission Assurance functions at each of the Centers it visits. At the Glenn Research Center (GRC), for example, the Panel found a robust program, with two major divisions: one devoted to system safety, quality, and reliability; the other to safety, health, and environmental issues. The Panel does not always find physical safety, employee health, and environmental management functions coordinated in this fashion, and this struck the ASAP as a worthwhile arrangement.

The ASAP has monitored the progress of the NASA Safety Center (NSC) from initial concept to full operation. Panel members said that they were gratified to observe that the purposes, policies and directions defined for the NSC at the outset have been implemented. The keys to success for the NSC will be in its demonstra-



tion of technical expertise and its ability to produce unmistakable benefits for NASA. The ASAP stressed that the NSC should soon come to be recognized across the Agency. NSC staff need to make it clear that they should be brought in from the start on developing projects.

In March 2006, a NASA contract worker was killed at the Kennedy Space Center. In its 2006 Annual Report, the ASAP noted the thoroughness of NASA's investigation of this mishap, but also observed how long it took to issue the final report on that investigation. In 2007, the Panel noted similar delay in concluding the investigation of a fire at GRC that took place in January 2006. If an unsafe condition has led to an accident or incident, the investigation findings need to be disseminated throughout the organization as quickly as possible.

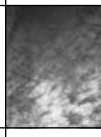
Workforce and Human Capital: The ASAP has long recognized the importance of human capital to NASA's missions, as well as to the Agency's ability to maintain appropriate safety standards. As the Panel reviewed NASA's workforce management programs in 2006, what the members found were initiatives largely lacking in clear direction. Briefings by Human Capital Management staff and others dealing with workforce issues had identified the challenges facing NASA, but they could provide only a general statement of the strategies and concepts planned to meet those challenges. In 2007, those organizations showed that they are now able to delineate the necessary specific tasks. That does not mean that NASA's formidable workforce problems have been solved, but it does mean that progress has been made in the effort to solve them.

NASA needs to retain the workforce resources to fly the Shuttle safely throughout each of its remaining missions, while at the same time building up the new skill sets needed for transition to the Constellation Program. NASA's dominant demographic problem is that many seasoned, knowledgeable technical experts are slated for retirement within the next five years. When NASA seeks to help fill workforce gaps by turning to skilled former employees, it is at a disadvantage in offering renewed employment to Federal retirees, because returning employees face a compensation penalty, under rules of the Office of Personnel Management (OPM). Those rules can be waived for retired Federal employees who are hired by the Defense Department. The ASAP recommended that NASA seek a similar waiver from OPM, in order to correct this disparity.

Safety Culture: Organizations can—and often do—change policies, procedures and the like. But it is harder for an organization, particularly a large one, to make changes in its culture. Nonetheless, since the *Columbia* accident, NASA has been working to make such changes, fostering more open internal communication and increased emphasis on safety, among other intended improvements in the way the Agency functions. The ASAP has encouraged such efforts.

NASA appears to be doing a better job than in the past in promoting safety from the top down. But if these gains are not firmly established throughout the Agency, old habits could later return. There appears to be inconsistency among the Centers, with some doing a better job than others of assessing culture and mining the data for ways to institute improvements. Previously, ASAP called for "efforts to institutionalize individual Center programs into more quantifiable, NASA-wide programs to reinforce safety as a core value within the Agency." Keys to success in such efforts include the work of the SMA organization as well as, recently, the advent of the NSC. In 2007, the Panel urged that the Safety Center take an aggressive leadership role in promoting safety as a paramount decision-making consideration throughout NASA design, development, and management.

NASA had a turbulent year in 2007, as it experienced an unusual assortment of nonoperational incidents. Among these were a murder/suicide at the Johnson Space Center (JSC), a strike by employees of United Space Alliance and the repercussions of the arrest of an astronaut. Taken individually, such events may not seem to have broad significance. But together, they may constitute indications, or what are known as weak signals, of internal stress within NASA. In response to the widely publicized arrest, the Astronaut Health Care System Review Committee was established. As reports of excessive alcohol use by astronauts in the preflight period began to emerge in the course of the Committee's investigation, NASA launched another inquiry focused on those allegations. In the ASAP's view, the Review Committee's report contains a number of valuable recommendations, but the Panel is concerned that many of these beneficial results are being obscured by the debate surrounding alcohol use.



II. Pivotal Issues

2007: A Year of Progress and Shifting Concerns

In its nearly 40 years of service, the Aerospace Safety Advisory Panel (ASAP) has maintained a constant focus on safety. Safety is in the Panel's name, and it is stressed in the Panel's charter. But the specifics of the ASAP's safety concerns have changed as conditions within NASA have changed. For example, the Columbia Accident Investigation Board (CAIB) addressed extensive shortcomings in areas such as the functioning of Shuttle Mission Management Teams and in Thermal Protection System inspection and repair. While these areas bear continued scrutiny, the ASAP has confirmed substantial progress that NASA has achieved in the more than four years since the CAIB issued its final report. (See the section below on the status of CAIB recommendations.) Furthermore, over the course of shorter timeframes as well, the ASAP has recognized significant progress. For example, in its Annual Report for 2006, the ASAP examined the challenges facing NASA in developing and maintaining the workforce it needs. By the end of 2007, these challenges were still very much in evidence, but the Panel could see that a concrete plan had been established to address them. (The section below on workforce and human capital discusses this in greater detail.)

Over the same year that advances such as these were being documented, other concerns have emerged or intensified, in the ASAP's estimation. Taken together, these concerns suggest a lack of consensus within NASA about the Agency's vision and direction, as well as how to implement them. In the Panel's view, NASA could benefit from a dialogue that would be thorough enough to provide clarity of purpose.

The ASAP poses these questions:

It appears to the Panel that some programmatic decision timelines are leaping ahead of availability of the data on which the decisions should be based. This may be a reaction to a NASA leadership style at some times in the past, when decision making was viewed as too slow and laborious. But has the pendulum now swung too far, such that programs have been instituted so precipitously that their objectives are not firmly established before the program is initiated?

Is mission driving requirements, rather than the other way around?

Could these developments have an impact on safety performance within the Agency?

The ASAP's inquiry in this matter stems from its role as an informed observer. Just as one person may notice the earliest signs of illness in another, the leading indicators of

a dangerous situation in an organization may first register with someone looking carefully from outside. Panel members, all of whom have experience with the development of technological programs, have found surprising anxiety among NASA employees associated with the Constellation Program. In program development, the early stages are usually marked by enthusiasm and optimism. If anxiety appears, it will be most likely toward the end of a program, when the hard realities of deadlines and resource limitations are paramount. If staff morale is at all diminished during this early phase in the lifespan of Constellation, that suggests to the ASAP that the rationale for the program may not be sufficiently understood or accepted within the organization. Constellation team members may be accepting top-level direction without fully understanding the purpose of what they are being directed to do. Furthermore, while the ASAP has observed this uncertainty in regard to Constellation, the Panel is concerned that the problem may not be limited to this one program.

In 2007, the ASAP became aware of a new approach to safety in vehicle design that has been adopted in the Constellation Program, one in which safety elements are incorporated after the basic design has been established. This "zero-base" approach will be discussed further in the section below on the Constellation Program. Because of the importance of this development, a major objective for the Panel in 2008 is to learn more about this apparent departure from the traditional method of ensuring safety in vehicle design. But initial impressions suggest to the ASAP that use of this approach constitutes another leading indicator of developing danger—danger that could compromise both mission success and mission reliability. Similarly, while the ASAP recognizes and supports the continuing effort to deploy humans in space exploration, the Panel sees evidence that the capabilities of unmanned alternatives for some tasks have not been sufficiently exploited. This is a concern that will be addressed in the section below on Operational Risk Management.

Warning signals such as these suggest to the ASAP that NASA system planning, particularly as it affects overall safety performance, is deficient in clear-cut, appropriate requirements. As a result, a course correction is called for before this trend continues. But at the same time, a countervailing argument can be made that what NASA needs, more than ever, is continuity. The ASAP recognizes the numerous and varied advances that have been achieved under the leadership of the current NASA Administrator, Dr. Michael Griffin. These improvements have resulted in significant safety gains for current NASA operations and safeguards for those that lie ahead. Among the recent advances is the reinstitution of the systems engineering

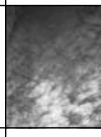
process, with suitable independent checks and balances. The technical governance model was established, and there are efforts to institute it Agency-wide. NASA's program integration role was restored. For years, integration had been the province of an outside contractor, and NASA functioned primarily as a contract administration organization. By establishing the integration responsibility for Constellation within NASA itself, Dr. Griffin was demonstrating a vote of confidence in the technical expertise to be found within the Agency he directs.

The ASAP believes it is vital that progressive measures such as these be preserved, even as NASA and the Nation undergo a period of transition. During the coming year, the United States will elect a new President and a new Congress. That shift may result in new NASA leadership, or the current leadership may continue. NASA can and should be preparing now for the coming changes in governmental leadership—including, possibly, changes within the Agency. That means, among other things, finding ways to institutionalize and even extend the recent gains.

To both new Government leaders and those returning to office, as well as to members of NASA's own community, the ASAP offers a theme that it considers to be key to mission success, particularly safety, in all of NASA's endeavors: *constancy of purpose*. Even in a time of flux, the Agency's devotion to its core objectives must endure. The Panel does believe that there is apparent need for improvement, as outlined above, in NASA's planning and management direction. But at the same time, care must be taken to prevent dissipation of the improvements already achieved. In the tension between these seemingly conflicting prescriptions, constancy of purpose serves as the harmonizing principle. That purpose, in the broadest terms, is to expand humanity's presence in the universe. Yet constancy does not equate to inflexibility in achieving that purpose. As technological capabilities improve, NASA should always remain open to new kinds of systems to deploy and new means of exploration.

The ASAP continues to offer its counsel to NASA, but at this significant point in national affairs, the Panel will also seek to convey several views to the incoming Presidential administration and Congress. Among these are:

- The decision about NASA leadership needs to be made as quickly as possible.
- In the interest of safety in future manned missions, a timely determination is crucial for the direction of the Vision for Space Exploration.



- NASA requires adequate funding to meet its commitments to space exploration and safety of flight.
- Failure in these areas could undermine not only this country's commitment to a presence in space, but also U.S. national defense and global standing. With the Constellation Program and other initiatives, NASA has embarked on projects of long duration and great complexity. Safety and efficiency in such undertakings depend on continuity of leadership and appropriate funding. Without that support, the advances that NASA has achieved in recent years could be jeopardized, and to later regain what was lost would impose great and unnecessary risk and expense.
- The ASAP has identified additional issues that it views as critical to safety and mission success in NASA's endeavors. Among these are:
- The constraints, both technical and programmatic, associated with current proposals to extend the Space Shuttle Program past its currently planned 2010 retirement date.
- The overhead cost burden involved in maintaining the present complement of 10 NASA Centers. The impact of that cost on NASA's ability to pursue all of its program commitments with an appropriate level of safety.
- The importance of fostering a culture throughout NASA that places the strongest possible emphasis on safety.

These issues will be discussed further in the sections that follow.

NASA Safety Performance in 2007

As discussed above, in 2007 the ASAP identified new areas of concern, but the Panel also noted the progress NASA made in dealing with ongoing issues ranging from workforce management to inspection and repair of the Shuttle's Thermal Protection System (TPS). In addition, during the past year, the ASAP recognized NASA accomplishments in other areas. For example, when the Panel examined NASA's policy on managing orbital debris, it found that policy to be effective and well-organized, aimed at minimizing hazards to humans on Earth, to spacecraft, and to other planets. Moreover, the ASAP determined that decision-making in this area is conducted at an appropriate organizational level within NASA. In another case, in 2006 the ASAP had raised concern about a proposal to process some Constellation vehicles with hypergolic fuels in the Vehicle Assembly Building

(VAB) at KSC, instead of on the pad. Subsequently, the Panel applauded not only the decision to abandon that proposal, but also the way that decision was arrived at, with program managers and safety staff cooperating effectively to develop safer and more efficient alternatives. Other "success stories," such as the continuing development of the NASA Safety Center (NSC) and the first test flight of the Stratospheric Observatory for Infrared Astronomy (SOFIA) aircraft, will be discussed in later sections. A section will also examine how the three Shuttle missions in 2007 demonstrated not only the degree of persistent risk associated with continued Shuttle operations, but also the improved methods for managing that risk.

The number and severity of NASA's on-the-job mishaps remained one of the lowest in the Federal workforce, but in 2007 the mishap totals did go up somewhat. During the first three years of the Safety, Health and Return to Employment (SHARE) initiative, NASA's lost-time injury and illness compensation claims had decreased from 141 in FY 2003 to 89 in FY 2006. In FY 2007, the figure rose to 105—still well below the SHARE goal of no more than 123. From FY 2003 to FY 2006, lost-time injuries had declined from 42 to 36, but in 2007 the total increased to 40—slightly higher than the SHARE goal of no more than 38. From FY 2003 to FY 2006, lost-production days had decreased from 9.9 days per 100 employees to 4.7. In FY 2007, the figure was 6.2—higher than during the previous year, but still lower than the SHARE goal of less than 15 days. For safety statistics on the operation of NASA's fleet of research aircraft, see the later section on that subject.

In addition to the ASAP's observations over the past year, as well as accident and incident data, another indication of NASA's safety performance in 2007 is the Agency's self-assessment. NASA's Chief Safety and Mission Assurance Officer cited these safety accomplishments for 2007:

1. NASA completed its first third-party indemnification process to provide indemnification to the company ATK for the Aeronautics Research Mission Directorate's Hypersonic Boundary Layer Transition (HyBoLT)/ Sub-Orbital Aerodynamic Re-Entry Experiments (SOAREX) flight, launched from Wallops Flight Facility and scheduled for 2008. Within the given parameters, the developer was able to satisfy NASA that appropriate safety procedures and practices were being followed.
2. NASA successfully returned its DC-8 to Dryden Flight Research Center from the University of North Dakota. In order to afford proper protec-

tion of one-of-a-kind assets, NASA's lease of the Palmdale Hangar for the housing of the DC-8 and the SOFIA aircraft (among others) included the appropriate fire-suppression system that meets NASA requirements.

3. NASA further clarified and began implementation of the Safety and Mission Assurance Technical Authority concept within programs and projects.

4. NASA conceptually adopted a role for formal "consent to take risk" as a part of NASA's Safety Model. This general model has been accepted by NASA's senior managers and will be codified in a NASA Policy Directive in Calendar Year (CY) 2008.

5. NASA updated its Human-Rating Requirements for Space Systems. This update includes a change to failure tolerance requirements that balances failure tolerance within the overall design and emphasizes design- and analysis-based failure tolerance determinations over arbitrary requirements compliance. These new requirements are going through final Agency review and are expected to be issued in early CY 2008.

6. NASA established program-level Safety and Mission Assurance requirements in the Constellation Program, accompanied by an extensive assessment of the traceability of those requirements to Agency-level safety and mission assurance requirements. This activity establishes a best practice for future safety and mission assurance use, but also has applications within other disciplines.

7. To build in better safety requirements, NASA adopted all safety-critical and high-priority mission success buybacks in the CEV/Orion point-of-departure design.

8. NASA Centers undertaking complex and critical work are making progress in achieving compliance with the International Aerospace Quality Standard AS 9100; NASA Safety and Mission Assurance experts are supporting this effort by performing gap analyses, providing guidance, and assisting several NASA Centers in achieving compliance with the standard, per the Agency mandate that any organization developing hardware for NASA be compliant with the standard.

9. On the first Monday of each month, the Office of Safety and Mission Assurance (OSMA) shares with NASA senior leadership a system failure case study that is applicable to NASA programs and projects. OSMA presents these briefs in the NASA Administrator's video teleconference as a top-level summary of a notable system failure. This information is supplemented with a documented case study and other related media available on an Agency Web page. The presentations are designed to foster a culture in which the lessons can be discussed in Agency-wide staff meetings, held subsequent to the Monday presentations. While many of these cases are not NASA-related, OSMA carefully chooses the content for each selected failure case study in order to have meaning that is applicable to NASA.

10. NASA developed a safety improvement methodology for identifying and assessing accident precursors and is applying this methodology to the Space Shuttle Program, International Space Station (ISS), and Constellation Program.

11. NASA is continuing to address improvements to safety culture throughout the Agency. NASA initiated a benchmarking activity with the Institute of Nuclear Power Operators (INPO) to exchange information regarding how the institute conducts nuclear power plant safety surveys.

ASAP Efforts in 2007

The ASAP continues to base its evaluations and recommendations on direct access to NASA, provided by the Agency at both Headquarters and Centers. These site visits would not be possible without the cooperation and support of NASA management. The ASAP holds quarterly meetings, at Headquarters and at Centers. These meetings include briefings by NASA staff, as well as public sessions in which the ASAP presents its findings. (One quarterly meeting in 2007 was canceled in the aftermath of a criminal incident at the Johnson Space Center [JSC].) A subset of Panel members conducts additional working site visits during the course of the year. A list of the ASAP's 2007 meetings appears in Appendix C of this report.

In addition to the ASAP's meetings and site visits, individual Panel members or groups of members attend key NASA meetings and formal reviews, such as Flight Readiness Reviews (FRRs), Safety and Mission Success Reviews (SMSRs), and Mission Management Team (MMT) meetings. Panel members also represent the

ASAP at meetings of other aerospace safety-related boards and committees. The following are some of these related activities in which ASAP members participated during 2007:

- STS-117: Joint Shuttle/ISS FRR; Joint Shuttle/ISS Delta SMSR; Joint Shuttle/ISS Delta FRR; MMT meetings
- STS-118: Joint Shuttle/ISS FRR; MMT meetings
- STS-125: Review Board for the Hubble Space Telescope Servicing Mission 4.
- Space Operations Mission Directorate/Exploration Systems Mission Directorate Transition Control Board (TCB)
- Astronaut Health Care System Review Committee
- Intercenter Aircraft Operations Panel meetings and safety reviews
- Follow-up actions on NASA/FAA meeting concerning interagency efforts in support of Space Act and certification
- Aerospace Medical Conference, Panel representative on engineering standards
- The International System Safety Conference and the International Association for the Advancement of Space Safety Conference, where Panel members headed up sessions dedicated to the advancement of safety

Based on its observations and assessments during 2007, the ASAP issued 18 recommendations to NASA. These dealt with a wide range of safety issues, such as technical authority, human capital and transition planning, mishap investigation, and standards programs, among others. (For a compilation of the Panel's 2007 recommendations, as well as earlier ones that remain open, and a status report on each of these recommendations, see Part III of this report.)

Planned ASAP Focus Areas for 2008

As indicated above, in 2008 the ASAP plans to inquire further into life-critical logistics and sustainability concerns, including resource requirements, associated with continuing service to the ISS. That inquiry will examine the risks associated with dependence on Russian spacecraft to meet those transport needs. Another topic on the ASAP's agenda will be NASA's response to the findings and recom-

mendations of the Astronaut Health Care System Review Committee. (See this report's section on safety culture for further discussion of this committee and other consequences that followed in the wake of the arrest of an astronaut.) Other topics planned for 2008 include:

- The "zero-base" approach to safety in vehicle design, cited above
- Constellation Program integration
- The NASA Safety Reporting System

For these topics and all others to be addressed at meetings with NASA staff, the ASAP requests as much specificity as possible in the information provided. The Panel also asks that the most well-informed NASA individuals participate in the ASAP reviews. For the most part, these requests have been granted, though there have been times recently when the ASAP has raised concerns following a meeting, and the Panel was told that other NASA staff members were more knowledgeable on that topic. In addition, when there are developments within NASA that have bearing on issues that the ASAP is chartered to scrutinize, the Panel requests that it be kept informed about those developments. An example is the zero-base approach. The Panel feels that the earlier it is brought into the process, the more effective it can be in providing a beneficial perspective. In fact, for the ASAP's insight to have the most value, the Panel needs to be aware when a measure is being considered, rather than being in the position of offering an assessment only after a decision has been made.

The ASAP Statutory Mandate and Membership

Congress established the ASAP's statutory duties through the NASA Authorization Act of 1968. Once the Federal Advisory Committee Act of 1972 (FACA) was enacted, that legislation governed the operation of the Panel. But after the Shuttle *Columbia* accident, Congress—through the NASA Authorization Act of 2005—reinstated the ASAP's original statutory duties. Amendments to the original Act included a requirement that the ASAP evaluate "NASA's compliance with the return-to-flight and continue-to-fly recommendations of the Columbia Accident Investigation Board (CAIB)," as well as a requirement to submit an annual report to the NASA Administrator and to Congress. Among the report's contents, the 2005 Act stipulated that the ASAP address NASA's compliance with the CAIB recommendations, and the report is to "include an evaluation of NASA's management and

culture related to safety." In 2007, the ASAP charter was renewed and amended, and the NASA Administrator signed the current charter on November 14, 2007.

Panel members with continuing terms in 2007 included: the ASAP Chair, Vice Admiral Joseph Dyer, USN (Ret.); Dr. James Bagian; Major General Charles Bolden, USMC (Ret.); Mr. John Frost; Ms. Deborah Grubbe; Mr. John Marshall; Ms. Joyce McDevitt; and Dr. Donald McErlean. Mr. Randy Stone was appointed to the Panel in 2007. Dr. Amy Donahue's term ended early in the year.

Program Safety

The Space Shuttle Program

In 2007 there were three Space Shuttle missions. All were successful in supporting and continuing the construction of the ISS. Yet two of the missions encountered operational difficulties before or during flight. Another mission, scheduled for 2007, was delayed by problems until 2008. A little over two weeks prior to the scheduled March 15 launch of STS-117, a hailstorm damaged the foam insulation of the External Tank (ET), requiring repairs and delay; a successful launch took place on June 8, 2007. During the launch of STS-118, on August 8, a piece of ice tore loose a piece of foam from the ET, which put a gouge in two tiles on the underside of the orbiter, *Endeavour*. While *Endeavour* was on orbit, the MMT decided against attempting a repair, and the orbiter later landed without incident. The original launch date for STS-122 was December 6, 2007 but faults in one of the ET's engine cutoff (ECO) sensor circuits resulted in two postponements, and Shuttle *Atlantis* eventually launched on February 7, 2008.

These episodes reflect the inherent vulnerabilities in the Space Transportation System (STS), which decades of development, operational experience, and post-accident modification have been unable to eradicate completely. But these same mission results also provide a more encouraging narrative: the vulnerabilities may persist, but NASA has greatly improved the means to deal with them. As ASAP members have observed Flight Readiness Reviews (FRRs), MMT meetings, and other Shuttle-related proceedings, the Panel representatives have found approaches taken that are thorough, orderly, and well coordinated, with a steady focus on vehicle integrity. When contributions are needed from different Centers, that support is readily available. The high correlation of the tile damage on STS-118 following

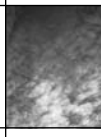
reentry to the predicted damage indicates much progress has been made in damage modeling. In refreshing contrast to times past, discussions are open and vigorous, with dissenting views welcomed. Participants are given ample time to resolve problems. When necessary, they appear to be generally successful in resisting pressure to launch. Representatives from the NASA Engineering and Safety Center (NESC) play a significant role in these efforts by providing an independent assessment of issues and concerns, as well as by identifying new hazards.

The later section in this report about NASA's responses to the CAIB recommendations will explore further the ongoing issues of ET debris shedding, orbiter hardening and Thermal Protection System (TPS) inspection and repair. Thanks to NASA's continuing efforts to correct the shortcomings identified through the *Columbia* accident investigation, Shuttle Program staff continue to gain understanding of foam behavior, and they are becoming leading experts on the materials used in the TPS, such as Reinforced Carbon-Carbon (RCC).

John Casper, Manager of the Space Shuttle Management Integration and Planning Office, summed up for the ASAP the Shuttle Program's stance: "Acknowledging that the Shuttle remains a developmental vehicle, we will continue to pursue improvements in the Shuttle system to understand its operational environment and identify and address newly identified risks and known aging challenges." The ASAP believes this is exactly the right approach that should be taken for the remaining Shuttle service, and the Panel notes with particular approval the emphasis on the Shuttle as a vehicle that will remain developmental all the way through its final flight. The Panel's endorsement is contingent on that continued understanding. As the CAIB detailed in its report, one of the conditions that made the *Columbia* accident possible was the implicit view, developed over time, that the Shuttle had transitioned from developmental to operational status. With NASA now recognizing that the Shuttle remains developmental, one consequence of that understanding should continue to be in the area of crew selection. Crew complement on the Shuttle should be limited to only those who are appropriate for a developmental vehicle.

The Constellation Program

The concerns raised by the ASAP in the opening section of this report—including unclear program objectives and requirements as well as the possibility of lost continuity in NASA leadership—could have an impact throughout the Agency. But since the Constellation Program is the largest-scale effort that NASA is now



undertaking, and since Constellation will become more prominent as the Space Shuttle Program concludes, these concerns have the greatest bearing on this new vehicle development program.

In a way, it is not surprising that Constellation is beset by unclear direction. The internal uncertainty about the purposes of this vehicle system is a function of the national debate that is still engaged over the Vision for Space Exploration. Once President Kennedy declared, "I believe that this nation should commit itself to achieving the goal, before this decade is out, of landing a man on the Moon and returning him safely to the Earth," there was little doubt about the purpose of the Apollo Program. Constellation does not yet enjoy such clarity of purpose. The ASAP urges not only NASA, but also the Federal authorities that oversee the Agency and the space policy experts that advise it, to strive more effectively for consensus on national priorities in space exploration. Among the many benefits of such a consensus will be a healthier Constellation Program, and consequently, a safer one.

While advocating for such improved future circumstances for Constellation, the ASAP continues to observe and comment on the program's current status. One longstanding problem for Constellation, and one of the reasons that the ASAP believes the program lacks clear direction, is in the design standards that have been established for it. It has been more than 30 years since NASA started developing its last human-rated system for space exploration, the Shuttle Program. This time, Constellation is subject to a set of NASA Procedural Requirements: "Human-Rating Requirements for Space Systems" (NPR 8705.2A). "A program is eligible for human-rating certification only if it meets engineering requirements, health requirements, and safety requirements" contained in that document. "Human-rating certification provides the maximum reasonable assurance that a failure will not result in a crew or passenger fatality or permanent disability." The requirements apply not only to the launch vehicles, but also to all the other systems that support human activity in space, such as space suits and surface vehicles.

The current human-rating requirements went into effect in 2005, and they are due to expire in 2010. But as SMA staff acknowledge, some portions are already out of date. Not only does an update have to be developed, but the organizational framework for administering these requirements has also been going through extensive revision. The ASAP questions whether—even with updating and reorganization—the standards will be as rigorous and comprehensive as they should be.

In 2007, the Panel issued several recommendations to address these concerns. Recommendation #2007-01-02 called on NASA "to continue to develop detailed safety requirements, including identifying the probability of the loss of crew, and track how these requirements are allocated and validated to the subsystem level." Recommendation #2007-01-03 addressed requests on behalf of Constellation for waivers of mandatory NASA safety requirements. Recommendation #2007-03-03 said, "The Constellation Program should initiate the development of an early hazard analysis in order to define program and project system-specific safety requirements." Finally, Recommendation #2007-01-01 applied not only to Constellation, but to the Agency's standards in general: "NASA needs to re-energize the Agency's engineering and safety standards programs to make standards current and useful and keep them as 'living documents.'"

The Panel stresses that "human rating" is not just a safety process. It is a design process that should be integrated into the development of the equipment from its inception. Yet that has not always been the case with Constellation. Designs were being drawn up and contracts were being let for major program elements before NASA had a complete set of human-rating requirements, agreed to across the board. That is not to say that requirements questions were left totally unaddressed. But the system reviews did implicitly leave many of those questions designated "to be determined." As with any major undertaking, it is likely to be cumbersome and expensive to commence a space program like this only to backtrack frequently for modifications, and the reliability of the ultimate results can also suffer.

Among the outcomes of this systemic shortcoming is the adoption of the "zero-base" approach to safety in Constellation design. Designers first turned to this approach when they were forced to modify the design of the Orion Crew Exploration Vehicle (CEV) when it was found to be exceeding allowable mass limits. In classic aerospace design, a vehicle is conceived and planned with redundancy and safety systems from the start, to ensure safety and reliability. If a component or system fails, one or more backups will be available to step in immediately. In the past, NASA vehicles have been designed according to these principles. But when the CEV over-weight problem came to light, a different approach was employed. In this "zero-base" approach, a minimal vehicle is designed, one that can accomplish the intended mission, but without all safeguards included. After that, additional safety features are incorporated into the design. But each such feature has to "earn its way in," through a demonstration that the safety benefit justifies the added mass and cost.

In its preliminary assessment of this design method, the ASAP has likened it to vertical takeoff and landing (VTOL) aircraft such as the Harrier. There was nothing inherently unsafe in this type of design, yet VTOL aircraft generally have had safety records that don't measure up to their conventional counterparts. The reason is that the goal of reducing weight so strongly drives design that, as a byproduct, safety margins are reduced. As a result, engineering margins that could protect against anticipated hazards were insufficient against the hazards that only came to light once the aircraft was in operation. Similarly, the ASAP is concerned that the "zero-base" design safety assessment process may not be capable of providing adequate protection against such "unknown unknowns."

When safety elements have to "earn their way" onto a design that has already begun to take shape, objectivity and consistency in the decision-making could be compromised. The inclusion of those elements could depend on the persuasiveness of the advocates making the argument that the proposed features are worth the added cost and weight penalty. The process can also be influenced by the perspectives of the individuals considering the argument. Vulnerabilities in the system can be compounded if the initial development budget is significantly constrained, as it is with Constellation. To learn more about the theory and practice of this design philosophy, the ASAP requested that NASA provide deeper insight in 2008 that would "explain how this approach assures an acceptable level of cumulative risk and provides adequate justification for implementing this alternate approach." (Recommendation #2007-04-01) The Panel is also seeking to determine the rationale for selecting this approach over more traditional methods.

In the development of Constellation, the ASAP does find that many of the SMA functions are being performed in a very satisfactory manner. For example, a risk-management review process is in place, including weekly meetings. But one problem area may be program integration. As noted earlier, NASA is undertaking direct responsibility for integration—as it did, for example, with the Apollo Program—rather than relying on a contractor for that purpose, which was the case with the Shuttle Program. The ASAP believes this could turn out to be a very worthwhile course of action, provided that there is full understanding of how it is to work and the integration organization is adequately staffed. It appears, though, that such understanding does not yet extend among all those involved with Constellation. There may still be some confusion between NASA and the Constellation contractors on this point. It is essential for safety and overall mission success in Constellation

that the integration function work smoothly and effectively. Accidents and other failures often occur at interfaces, and it is those kinds of outcomes that proper integration should be able to prevent.

Improving the integration within Constellation should be one of the objectives for the Program Manager. For that reason, and to secure other benefits—such as keeping the workforce informed about where the leadership stands—the ASAP has urged that the Constellation Program Manager be given greater visibility, within the Agency and also to Congress and the public.

As the section above pointed out, and as emphasized in the CAIB Report, the Space Shuttle should be considered a developmental vehicle throughout its service life. When that recognition has been obscured, safety has been compromised. A similar understanding is warranted for Constellation. It may be that the Constellation vehicles will eventually transition to operational status. But at least initially, and for the foreseeable future, they should be recognized as developmental, providing all the safeguards associated with that designation.

The Shuttle-Ares Gap

The last Space Shuttle mission is scheduled for 2010. Under current Constellation Program plans, Ares I will be ready to transport crew members and cargo no earlier than 2015. That leaves a gap of at least five years in which the only means to service the International Space Station (ISS) will likely be via foreign spacecraft, primarily Russian. To address that gap, NASA is faced with several alternatives, all of them involving substantial risk:

- Extend the Shuttle Program
- Accelerate development of Ares
- Remain dependent on Russian vehicles
- Increase reliance on privately developed U.S. spacecraft, under the Commercial Orbital Transportation Service (COTS) Program

As it observes the decision-making to choose which course to follow, the ASAP asks: How much risk is attached to continued reliance on the Russian Soyuz and Progress spacecraft? Once the primary link to the ISS is via the Russian fleet, will there be pressure to keep that fleet flying, even if a hazardous condition comes to light? Panel members, observing the ISS MMT, note the difficulties experienced by NASA officials in obtaining information on operational problems encountered by

their Russian counterparts. In the coming year, the ASAP will inquire further about Russian safety performance in space and in particular, the significance of any recent in-flight anomalies involving Russian assets.

Postponing retirement of the Shuttle would have costly effects. Given the age of the three remaining Orbiters, extending their service life would require elaborate reconditioning work, with modification or replacement of numerous components. In order to maintain the level of safety and reliability to which the Shuttle Program has aspired from the start, all of that reconditioning work would have to be tested against rigorous standards. The expense in all this effort could draw heavily against Constellation if additional funding is not forthcoming. Furthermore, even a fully reconditioned Shuttle would still be subject to the risks inherent in its design—risks that were demonstrated by the *Columbia* accident, the investigation of that accident, and NASA's subsequent efforts in response to the investigation findings. Foam shedding from the Thermal Protection System of the External Tank can be ameliorated, but apparently not eliminated, and the orbiter can be hardened but not rendered impervious to the impact from liberated foam debris. These circumstances are discussed further in the report section below on NASA's responses to the recommendations of the CAIB.

Extending the Shuttle Program would involve rescheduling, i.e, moving some of the last scheduled flights past 2010, and it could also mean planning additional flights. Both changes would be difficult, but the latter would present the greater challenge. If the decision were made to fly the current spacecraft more than what is planned, the process would need to begin immediately. In fact, it may already be too late. The cost of restarting production lines for replacement components could be prohibitive. Typically, when the end of an aircraft or spacecraft program is in sight, subcontractors start moving on to new work. That migration has already begun. Qualified technicians have already begun retiring and otherwise departing. If the "point of no return" has not yet been crossed for the Shuttle's industrial support base, then those companies that remain will need guarantees of future business in order to remain available to the program.

Safety Performance in the Operation of NASA Aircraft

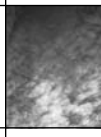
In recent years, the management of NASA's flight operations has been able to achieve an improved safety record, compared with earlier mishap rates—despite an aging aircraft fleet—and that trend was generally maintained in CY 2007. Once again there were no Class A mishaps, just as there had been none in 2006, 2005, or

2004. Class C and D mishaps held steady at five in each category, the same figures as in 2006. Only in Class B was there an increase: one such mishap in 2007, the first in that category since 2004, when there were two. Only three of the 2007 mishaps occurred during flight. NASA's mishap profile is consistent with those of other Federal agencies.

These totals, including both ground and in-flight reports, are from the NASA Incident Reporting Information System (IRIS). The classification standards in this program were modified in 2007, to account for incidents more accurately. Under the new system, Class C mishaps dropped from eight in 2006 to three in 2007, and Class D went from eight to five. A Class A mishap is defined as an accident resulting in a fatality, an aircraft hull loss or a direct cost of $1 million or more; a Class B mishap is one resulting in a permanent partial disability or damages of at least $250,000 but less than $1,000,000; Class C involves a cost of at least $25,000 but less than $250,000; and a Class D mishap is one with damages of at least $1,000 but less than $25,000. This classification system is widely used among Federal agencies.

The single Class B mishap involved a Gulfstream III based at JSC, which was being flown to Dallas Love Field for a routine inspection. While inspecting the aircraft after arrival, the flight engineer found damage to the upper right engine pylon panels. Further examination revealed annealing and buckling of the aircraft skin and support structure adjacent to the engine pylon pneumatic precooler assembly, as well as deformation and delamination of the closeout panels on the top and bottom of the pylon section. Investigation included interviews with the assigned maintenance technicians and management personnel, coupled with a review of contractor and Government technical maintenance data and records, but no source of the damage could be identified. Although the investigation was closed without determining probable cause, the review did find two contributing factors.

In its continuing effort to standardize aircraft operations and procedures across the Agency, NASA aligned its aircraft operations program in 2007 with the standards of the General Services Administration's Interagency Committee for Aircraft Policy (ICAP). The purpose of the ICAP is to promote adherence to the highest safety practices in the operation of Federal aircraft. On November 27, 2007, the ICAP awarded NASA the distinction of a Gold Standard Certificate for superior safety performance. This award recognizes Federal agencies that demonstrate that they meet or exceed the safety guidelines outlined in 41 Code of Federal Regulations



(CFR) 102-33 and the Federal Aviation Regulations that pertain to an agency's flight operations.

To earn its ICAP Gold Standard designation, NASA had to verify its compliance with guidelines established for Federal agencies that own and/or operate aircraft. The guidelines serve as a framework for the agencies to develop their own comprehensive flight program standards. The ICAP's intent in developing these guidelines is to enhance operational safety and effectiveness. Each agency uses the guidelines to develop, implement and maintain agency-specific aviation program standards. The agency is solely responsible for writing its own standards, based on the guidelines, and for managing its own flight program. The participating agency is also obligated to institute a self-oversight program that includes independent inspection services.

In a comprehensive effort to improve its inspection and compliance program, NASA's Aircraft Management Division updated the Agency's Functional Review Checklist by incorporating the new requirements of the updated NPR 7900.3B. These changes reflect major adjustments to NASA's "Airworthiness and Maintenance" and "Aviation Safety" chapters, and the addition of two new chapters and operating standards for "UAV [Unmanned Aerial Vehicle] Operations" and "Airfield Operations."

On April 26, 2007, after more than 10 years of significant aircraft modifications and program difficulties, NASA successfully flew its Stratospheric Observatory for Infrared Astronomy (SOFIA) aircraft, a Boeing 747SP, on its first test flight. SOFIA is an airborne observatory that will study the universe in the infrared spectrum. Besides this contribution to scientific inquiry, SOFIA will be a valuable asset in the development of new observational instruments and techniques, and in the education of young scientists and teachers in the discipline of infrared astronomy.

After that initial test flight, the SOFIA aircraft was flown from an overhaul facility in Waco, Texas, to the Dryden Flight Research Center at Edwards Air Force Base in California for continued flight testing. Operational management has been transferred from the Ames Research Center to Dryden, but management of the science missions assigned to the aircraft will still be conducted by staff at Ames. SOFIA's successful flight tests and progress toward full operational capability constitute a major milestone for an important program. To date, those flight tests demonstrate that the aircraft is being operated with the requisite level of safety. This achievement is a credit to the NASA aviation management team's renewed focus on airworthiness standards and capabilities.

Also during 2007, the NASA Intercenter Aircraft Operations Panel (IAOP) made significant progress in its efforts to identify "best practices" within NASA aviation programs and in similar Government and industry aircraft operations. The IAOP's 2007 reviews were conducted at NASA's Langley, Glenn, and Ames Research Centers. An ASAP observer participated in the Ames review.

The IAOP Aviation Safety Officer (ASO) subpanel held its annual conference on August 14–16, 2007. This visit provided NASA ASOs with the opportunity to benchmark the latest in unmanned vehicle operations and accident trends. Additionally, the most recent semiannual meeting of the IAOP was dedicated to (UAV) operations and included several prominent guest speakers from the science and UAV test communities. Oversight of UAV operations at each NASA Center is now the subject of focused functional reviews to ensure compliance with the policies of both NASA and the FAA. NASA, together with the ASAP, will continue to look for further opportunities to benchmark industry practices in aviation safety and UAV operations. Overall, the ASAP has found, NASA's UAV program continues to set an enviable standard, which other Federal agencies would do well to emulate.

In its *Annual Report for 2006*, the ASAP called on NASA to "standardize its approach to measuring safety culture within the Centers." One NASA initiative in this area is to establish a standard aviation management cultural survey process and to encourage all Center aircraft operations departments to make use of the process. NASA's Aircraft Management Division is working with the NASA Safety Center to develop this cultural survey program. (See also the section below on safety culture.)

Technical Authority

Based on its investigation of organizational shortcomings within NASA, the CAIB called for, among other corrective measures, the establishment of an "independent Technical Engineering Authority." Such an authority would be responsible for technical requirements and all waivers to them. It would guard against the potential for conflict of interest when, for example, the Space Shuttle Program Manager—simultaneously responsible for resources and schedule as well as safety—would be called on to approve waivers of technical requirements, even if those waivers could compromise safety. That had been the arrangement prior to the loss of STS-107. Initially, NASA began to reorganize along the lines recommended by the CAIB. But Administrator Griffin called for some modifications to the remedy. As recommended by the CAIB, he separated the management paths for technical authority

and safety. But he also instituted changes in those paths, with the Centers taking on greater control. Lead engineers are to still answer ultimately to the Chief Engineer, but the lines of authority are to be channeled through the Centers' engineering directorates. A similar technical governance model applies to Safety and Mission Assurance authority and to Health and Medical authority.

In 2006, the ASAP indicated its acceptance of this approach, but also its concern about the time that would have to be taken to implement it. The Panel said that during the following year, it would be watching for firm evidence that the transition was under way. In 2007, the ASAP did find evidence of successful integration, but not enough. The principles of technical authority seem to be well established at Headquarters, but at the Center level, the results are more mixed. As a case in point, the ASAP contrasts its experience during a site visit to the Glenn Research Center with a visit in the same year to the Dryden Flight Research Center. Meetings at Glenn suggest that the purpose of the new technical governance model is understood there, and an effort is well under way to implement a policy consistent with the restructuring at Headquarters. At Dryden, on the other hand, the impression is more of some uncertainty on this point. The Panel's observations at Dryden did not suggest opposition to the new approach, but rather, a lack of the understanding of how it is to be implemented. The experience at Dryden indicates that the leadership at some Centers may have the willingness to make the necessary changes, but the message on how to do that has not yet gotten through. In some cases, the directors of Centers less involved in the human spaceflight program may have been able to function with relatively more autonomy than those participating extensively in that cross-Agency effort. In those cases of greater autonomy, the Center directors—more than the program authority—have often been the principal decision-makers for program safety as well as facilities management.

One of the ASAP's 2007 recommendations (#2007-01-09) stated: "NASA should implement a consistent process to provide Technical Authority direction, alignment and communications to ensure that the working level of NASA is fully informed on Technical Authority. Provide the Panel with feedback on the effectiveness of its implementation." One example of that feedback is a briefing to the ASAP by the SMA Director of JSC, during the Panel's third quarterly meeting of 2007. Complete with examples of the written material provided to JSC staff, that briefing demonstrated that the SMA organization at JSC is doing a thorough job of educating

Center staff about the purposes and procedures of the technical authority initiative. Nonetheless, the Panel remains concerned that comparable education efforts are not in place at all Centers and that in general, implementation is still proceeding too slowly. If there is a change in NASA leadership, that implementation could be slowed further or even halted. This is another reason that the ASAP encourages immediate transition planning to prepare for prospective changes in NASA leadership and congressional and White House oversight: to avoid interruption in adopting the valuable organizational enhancement that the technical governance model represents.

Two other recommendations touching on technical authority that the ASAP issued in 2007 are: #2007-01-08, which urged NASA to standardize the nomenclature in organization charts for programs and projects, and to cite the required technical authorities in those charts; and #2007-03-05, which called for an expansion of the duties of the Safety Technical Authority at the program and project level "to include an independent assessment to verify that the risk is properly characterized and also [to give] advice on the acceptability of the risk."

Resource Constraints

In 2006, the ASAP examined NASA's Safety and Mission Assurance budget, with the aim of making sure that the SMA organization had sufficient funding to fulfill its safety advocacy and leadership mandate. In 2007, the Panel broadened its budget inquiry, asking whether NASA overall has sufficient resources not only to design and operate spacecraft and aircraft safely, but also to maintain its historic commitment to vital research promoting the safety of flight.

At NASA Centers, the ASAP has at times found indications of the current budget priorities: in order to pursue current space programs, primarily Constellation, aeronautical research must be cut back. For illustration, Panel members have only needed to look around those Centers. At facilities that for years had been the sites of vigorous scientific inquiry, producing numerous advances in the safety of air travel, the flight lines are now underutilized; many of the wind tunnels have been shut down.

The ASAP speaks in no way as an opponent of the space program. Several Panel members have devoted substantial portions of their careers to that program (some

as astronauts) and all the members believe it is essential for the exploration of space to continue. But the ASAP does not believe that the aeronautical side of NASA's mandate should be sacrificed in the process. As safety advocates, Panel members believe it is their duty to speak up in the interests not only of those who fly into space or come in contact with spacecraft, but also of the millions who rely every day on the National Airspace System (NAS) to travel, often over long distances, without harm. Commercial and private use of that system has been increasing dramatically, and forecasts are for that increase to continue unabated. Despite such accelerating traffic demands on the NAS, the standards of air safety remain high—thanks in large measure to innovations developed or supported by NASA, such as advances in landing systems, air traffic management, airborne collision avoidance, and safeguards against runway incursions. NASA research has been key to airborne wind shear detection systems, grooved runways, and technologies to avoid airframe icing, among numerous other safety contributions. The diminished role of NASA in this field represents a loss to air safety progress, which is unlikely to be made up by other institutions.

Furthermore, some of Constellation's preliminary challenges can be traced to resource handicaps. As ASAP members can attest from their experience developing new technologies, ample early investment can often be crucial to ultimate program success. Such up-front expenditures can cover design trades and other means to ensure that the new system is taking shape in the best possible way. In contrast, it appears that Constellation development has at times been financially constrained at the early stages. The ASAP notes reports, for example, that some planned early testing of Ares I may be delayed because of an anticipated budget shortfall.

In light of this harmful impact of resource constraints on so much that NASA undertakes, the ASAP argues for a NASA budget sufficient to relieve those pressures. But the Panel also takes note of one factor that is exacerbating the situation for NASA. That is the financial burden of operating 10 Centers throughout the country. This is similar to the situation the Department of Defense (DOD) experienced with excess capacity prior to establishment of the Base Realignment and Closure Commission. Thanks to insight gained at several Centers in 2007, the Panel observed the formidable costs of maintaining and—where necessary—upgrading roads, buildings and other infrastructure components of a large research complex. The ASAP does appreciate the significance of each of the NASA Centers, and the Panel is fully aware of the Centers' many contributions in both the past and

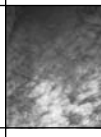
present. If resources were not so limited, the Panel would support retaining all of the NASA facilities. But if doing that means spending so much on overhead that core elements of the NASA mission are compromised—including the commitment to safe operations and the ability to contribute to public safety—that strikes the Panel as too high a price.

Operational Risk Management

Standardization in the Use of the Risk-Management Tool Set

The ASAP is a firm believer in standardization. When contradictory standards or differing procedures are present in the same enterprise, the likelihood of mishap is apt to increase. An example of such an outcome is the loss of the Mars Climate Orbiter in 1999, attributed by the Mission Failure Investigation Board to "the failed translation of English units into metric units in a segment of ground-based, navigation-related mission software." The ASAP recognizes that 100 percent standardization would be difficult to achieve throughout the numerous projects of an organization as large as NASA. Nonetheless, maximum uniformity is still a worthy goal. As the ASAP surveys the range of NASA enterprises, the Panel is struck by the profusion of definitions, design standards, and process requirements it finds, including many that are in direct conflict with one another. One example is the incompatibility of certain SOFIA hazard analyses performed at the Ames Research Center with formats normally used at the Dryden Flight Research Center. When SOFIA was transferred from Ames to Dryden management, these hazard analyses had to be redone. At least initially, standardization was even lacking within the computer-aided design (CAD) programs used in the design of a single Constellation vehicle, so that it was hard to coordinate the use of drawings for one stage with those for another. As noted above in the section on the Constellation Program, problems that can lead to system failures often occur at interfaces.

NASA properly makes use of a variety of risk-management tools and presentations. This is one of the areas where greater standardization is needed. For example, the ASAP has advocated the adoption of a risk matrix that is more standardized than the broad assortment found among NASA programs today. The Panel is impressed with the approach developed for Constellation. Not only is there a matrix that displays risk levels and degrees of severity, but there is also a decision-making matrix to go with it, which defines the program authority at each point. That matrix indicates



who has the responsibility for accepting the indicated risk. In Recommendation #2007-03-04, the ASAP said NASA should adopt this approach Agency-wide. In the same recommendation, the Panel also called for "improved definitions associated with quantification, thus providing a basis for NASA to allocate resources to the most significant hazards."

Current NASA Procedural Requirements provide some direction on how individual programs are to develop risk matrices, but the programs are still allowed relatively free rein in this area. Individual programs therefore do devise their own matrices and then usually become committed to them. The prevalent view among one program's staff is likely to be that other programs' tools won't work for them, being either too sensitive or not sensitive enough. The position of SMA leadership has generally been that the programs are entitled to this individuality. The ASAP takes the contrary view, that there is greater value in integration and consistency across the programs, so that the programs can communicate, as much as possible, with a common language. If a standard risk matrix is agreed upon within the Agency—say, one set up with a 5x5 presentation—and one office finds that to constitute too much granularity, too high a level of detail for their purposes, then that office does not need to make use of all the cells. The office can simply leave some of the boxes in the matrix unfilled. Even if there are some variations in its usage, a comprehensive and standardized system for assessing, communicating, and accepting risk is preferable to relying on a number of separate, inconsistent tools and presentations. In 2008, several ASAP members plan to undertake a further study of this issue.

Manned Versus Unmanned Space Exploration

In 2005 and again in 2007, the ASAP issued recommendations calling on NASA to establish a formal review process of new mission proposals, to make sure that the most appropriate use is made of unmanned systems for some of the tasks in space exploration, to minimize risk to humans whenever possible. As the Panel has noted repeatedly, the use of autonomous, semiautonomous, or remotely operated technologies can eliminate risk to the humans involved, and robotic systems can also perform many functions that are ill-suited to human capabilities or even beyond them. On land, sea, and air, the roles for robotic systems grow steadily in number and sophistication. And those applications have long extended into space. NASA has made extensive use of unmanned spacecraft and rovers. But what is still missing is the kind of review process described in the ASAP recommendations. NASA needs a systematic method to analyze the risks, costs, and other considerations in assigning missions to its human and nonhuman explorers.

Safety Program Management

The ASAP continues to examine the Safety and Mission Assurance functions at each of the Centers it visits. At the Glenn Research Center (GRC), for example, the Panel found a robust program, with two major divisions: one devoted to system safety, quality and reliability; the other to safety, health, and environmental issues. The Panel does not always find physical safety, employee health, and environmental management functions coordinated in this fashion; and this struck the ASAP as a worthwhile arrangement. The Panel was also encouraged to find that the SMA Director at Glenn has two independent paths through which he can express his views: he can go through the organization of the project at hand, but he also understands that he has a direct path to the SMA Director at NASA Headquarters.

At the JSC, the ASAP was impressed with the SMA training program and urged that it be shared with other Centers, the NASA Safety Center (NSC), and OSMA, "in pursuing a goal of providing Agency-wide safety training. JSC's high-quality training program may provide a good basis for standardization." (Recommendation #2007-03-01)

The ASAP has monitored the progress of the NSC from initial concept to full operation. Panel members said that they were gratified to observe that the purposes, policies, and directions defined for the NSC at the outset have been implemented. Annual funding for the Safety Center is $7 million, which is only slightly more than half of what was requested. With that limitation, the ASAP found, NSC officials are setting the right priorities and addressing the most demanding issues first.

The keys to success for the NSC will be in its demonstration of technical expertise and its ability to produce unmistakable benefits for NASA. The ASAP stressed that the NSC should soon come to be recognized across the Agency the way its engineering counterpart, the NASA Engineering and Safety Center (NESC), is now recognized. As the Panel members advised, NSC staff need to make it clear that they should be brought in from the start on developing projects. The ASAP also said that there needs to be a clear-cut division of responsibilities between the NSC and the NESC.

The NSC also has a significant role as an incubator for Safety Fellows and other leaders in the safety community. The Safety Fellows are comparable to the Technical Fellows at the NESC. The ASAP issued a recommendation (#2007-01-05) urging that the Safety Fellows be "developed and empowered" similarly to the Technical

Fellows program. The Panel was therefore pleased to see that several high-grade positions have been approved for the Safety Fellows; these positions are to be filled in 2008. To see safety professionals at this level in the Agency is an encouraging sign of the importance placed on safety. But as the ASAP pointed out, even with these positions and the other vital roles of the NSC, Center directors and SMA managers still have responsibility to maintain the proper focus on safety throughout NASA.

In March 2006, a NASA contract worker was killed in a fall on the roof of a warehouse at the Kennedy Space Center. In its *Annual Report for 2006*, the ASAP noted the thoroughness of NASA's investigation of this mishap, but also observed how long it took to issue the final report on that investigation. In 2007, the Panel noted similar delay in concluding the investigation of a fire at GRC that took place in January 2006. If an unsafe condition has led to an accident or incident, the investigation findings need to be disseminated throughout the organization as quickly as possible. The ASAP therefore issued a recommendation (#2007-04-02) stating, "NASA Headquarters needs to provide for more timely completion, review, and release of major mishap investigation reports, utilizing the support of the NASA Safety Center if needed."

Workforce and Human Capital

The ASAP has long recognized the importance of human capital to NASA's missions, as well as to the Agency's ability to maintain appropriate safety standards. As the Panel reviewed NASA's workforce management programs in 2006, the members found initiatives that were largely lacking in clear direction. During the following year, the view improved significantly. As one of the encouraging signs, the Panel could see the beginnings of a progression from the general to the specific. Briefings by Human Capital Management staff and others dealing with workforce issues in 2006 had identified the challenges facing NASA, but they could provide only a general statement of the strategies and concepts planned to meet those challenges. In 2007, those organizations showed that they are now able to delineate the necessary specific tasks. That does not mean that NASA's formidable workforce problems have been solved, but it does mean that progress has been made in the effort to solve them.

The workforce requirement for any institution, public or private, is to maintain a staff with the skills and knowledge needed to fulfill all the responsibilities that

the institution has undertaken. In NASA's case, one huge undertaking is nearing conclusion, while another is commencing. The Agency needs to retain the workforce resources to fly the Shuttle safely throughout each of its remaining missions, while at the same time building up the new skill sets needed for transition to the Constellation Program. Complicating this process are problems of retention and changing demographics, as well as the specialized, technical nature of the skills involved in developing and operating a fleet of spacecraft.

The ASAP has gained deep insight into workforce management from Toni Dawsey, Assistant Administrator for Human Capital Management (HCM); John Olson, Exploration Transition Manager, Exploration Systems Mission Directorate (ESMD); and Joel Kearns, SOMD Transition Manager, Space Operations Mission Directorate. They described how their organizations have been working to maintain a workforce not only of sufficient size, but also with the right makeup of competencies. They have integrated more than 75 human resource systems, involving more than 150 tasks. Those tasks are distributed over three objectives: understanding mission requirements, aligning skills in the workforce with the mission, and enabling more effective and efficient human resource operations. In addition, the SOMD/ESMD Transition Control Board, which is responsible for facilitating the transition from Shuttle to Constellation, has been focusing on not only hardware and facilities issues, but also the workforce reallocation required in that transition. All-hands meetings have been held at both KSC and JSC. The ASAP's Recommendation #2007-01-07 called for coordination between transition planning and human capital planning "to develop an Agency-centric Human Capital Plan that balances shortages, excesses and capabilities between, as well as within, Centers."

Under the Strategic Workforce Planning Governance Structure established for NASA, workforce planning technical teams are led by human resources staff, but they also include specialists in the budget process and in program analysis and evaluation. The workforce planning teams have developed, among other things, a workforce planning guide with standard nomenclature, as well as mapping systems for both Shuttle and Constellation. So far, these systems apply only to civil servants, but they will also need to include contractors. The teams have managed early-out programs that have released some 1,200 employees. And they have sought legislation to permit bonus offers, to encourage certain employees to transfer duty stations.

NASA's dominant demographic problem is that many seasoned, knowledgeable technical experts are slated for retirement within the next five years. The problem is exacerbated at some Centers by the possibility of competing offers for these experienced employees coming from the DOD as the military goes through the process of base realignment and closure. This is a particular concern for the Marshall Space Flight Center in Huntsville, AL. The Defense Department's Army Materiel Command and Ballistic Missile Defense Agency are to be relocated to Redstone Arsenal, near Marshall, creating several thousand anticipated technical openings in the Huntsville area. In addition, when NASA seeks to help fill workforce gaps by turning to skilled former employees, it is at a disadvantage in offering renewed employment to Federal retirees, because returning employees face a compensation penalty, under rules of the Office of Personnel Management (OPM). Those rules can be waived for retired Federal employees who are hired by the Defense Department. The ASAP recommended that NASA seek a similar waiver from OPM, in order to correct this disparity. (Recommendation #2007-04-04)

The Panel also stressed the value of apprenticeship and other training programs in attracting and retaining the kinds of technicians needed at NASA. One reason that Defense Department laboratories are currently facing a technician shortage is that apprenticeship programs were terminated in the late 1980s and early 1990s. As a result, DOD is now renewing those programs, and that can serve as a worthwhile example for NASA, according to the ASAP.

Safety Culture

Organizations can—and often do—change policies, procedures and the like. But it is harder for an organization, particularly a large one, to make changes in its culture. Nonetheless, since the *Columbia* accident, NASA has been working to make such changes, fostering more open internal communication and increased emphasis on safety, among other intended improvements in the way the Agency functions. The ASAP has encouraged such efforts, and so have the CAIB, the Return to Flight Task Group and congressional oversight.

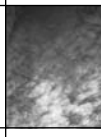
The ASAP continues to see progress in this area. As noted above, direct Panel member observation of Flight Readiness Reviews, Mission Management Team meetings, and other group decision-making processes confirms the freely flowing dialogue that prevails. In contrast to the days before the loss of *Columbia* and its crew, dis-

senting views are now welcomed. In a message to NASA staff on January 28, 2008, NASA's Day of Remembrance for those lost on Apollo 1, *Challenger*, and *Columbia*, Administrator Griffin said, in part:

> We employ the organizational hierarchy and its accompanying flow of authority and responsibility to serve us, not to tie our hands. A healthy organization allows information to move up, down and sideways, and pushes decisions, and trust in those decisions, down to the place where they can best be made. An unhealthy organization prevents needed information from flowing to those who must determine where that place is.
>
> . . . So, if you find yourself with a concern that you are reluctant to speak about to your supervisor, or to have a conversation about outside your "chain of command," think about what that can cost. If you're the one hearing a concern, think about whether you're really listening, or just waiting politely until the speaker is done talking, and think about what that can cost.
>
> . . . The authority to provide direction lies in the chain of command, and belongs there. But to require the "chain of command" to be coincident with the "chain of communication" produces only dysfunction. The information that provides the situational awareness to allow good leadership, and good followership, belongs to us all.
>
> Remember that the next time you are reluctant to speak, or impatient with listening, and remember the real reasons that we have a Day of Remembrance. The more we remember those real reasons, the longer it will be before we have another cause for mourning.

The ASAP applauds such statements and urges NASA leadership to find more ways to broadcast that message. The Panel is persuaded that a positive cultural shift is taking place within NASA, and barriers to communication are falling.

NASA appears to be doing a better job than in the past in promoting safety from the top down, emulating the best in industry practices. But if these gains are not firmly established throughout the Agency, old habits could later return. Initially, following publication of the CAIB report, NASA embarked on an Agency-wide program to assess culture and correct the deficiencies that came to light. In 2005, the Administrator moved to decentralize this effort to the Centers. The ASAP did not support this move and remains concerned about its impact. There appears to



be inconsistency among the Centers, with some doing a better job than others of assessing culture and mining the data for ways to institute improvements. In its *Annual Report for 2006*, the ASAP called for "efforts to institutionalize individual Center programs into more quantifiable, NASA-wide programs to reinforce safety as a core value within the Agency." Keys to success in such efforts include the work of the SMA organization as well as, recently, the advent of the NASA Safety Center. In 2007 the Panel urged that the Safety Center take an aggressive leadership role in promoting safety as a paramount decision-making consideration throughout NASA design, development, and management.

The ASAP hopes that the Safety Center will make a significant contribution in reaching one SMA goal: to develop a new standardized climate survey, available for use across the Agency, by the end of 2008. The response rate to an earlier follow-up survey had been disappointing—apparently owing to the perception that the survey did not provide a sufficient guarantee of anonymity to respondents, according to NASA's Chief Safety and Mission Assurance Officer. Surveys conducted at other organizations are now being examined as benchmarks, including their approaches to anonymity.

NASA had a turbulent year in 2007, as it experienced an unusual assortment of nonoperational incidents. Among these were a murder/suicide that claimed two lives at JSC, a strike by employees of United Space Alliance, and the repercussions of the arrest of an astronaut. Taken individually, such events may not seem to have broad significance. But together, they may constitute indications, or what are known as weak signals, of internal stress within NASA. The ASAP, as well as other observers of the Agency, stay on the lookout for such signals. The lesson in remaining vigilant for these signals, according to Major General Charles Bolden, who serves on both the ASAP and the STS-125 HST SM-4 Review Board, is "never let your guard down" against "perpetual challenges in the areas of communication and leadership."

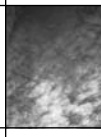
The widely publicized arrest of an astronaut in February 2007 led to several investigations. One was an internal JSC inquiry into the medical and behavioral health services available to astronauts at the Center. For another investigation, the Astronaut Health Care System Review Committee was established. One member of that committee is Dr. James Bagian, a former astronaut and a member of the ASAP. Finally, as reports of excessive alcohol use by astronauts in the preflight period began to emerge in the course of the Review Committee's investigation, NASA launched another inquiry focused on those allegations.

In the ASAP's view, the Review Committee's report contains a number of valuable recommendations, in areas such as the astronaut selection process and the need for open communication between senior leadership and flight surgeons, trainers, and astronauts. The ASAP is concerned, though, that many of these beneficial results are being obscured by the debate surrounding alcohol use. To track subsequent developments in these areas, and to determine whether further action on the ASAP's part is called for, the Panel has requested additional insight from NASA, identifying the issues that will be addressed from the report of the Review Committee, the plans for addressing them, the timeline for closing out those issues, and an evaluation of how successfully each plan has been implemented. (Recommendation #2007-04-03)

Status of CAIB Recommendations

Since 2005, the ASAP has had the responsibility to monitor NASA's compliance with the recommendations of the Columbia Accident Investigation Board (CAIB). As explained in the first section, that responsibility was established by a provision of the NASA Authorization Act of 2005. The CAIB began its investigation on the day of the Shuttle *Columbia* accident, February 1, 2003. As the Board issued its final report, later that year, it issued 29 recommendations, along with numerous additional findings and observations. Fifteen of those recommendations were designated "return to flight" (RTF)—indicating that they should be implemented before Space Shuttle flights resumed. While the CAIB was dissolved after publication of its final report, a separate independent body, the Return to Flight Task Group (RTF TG) was chartered to assess NASA's efforts to comply with the RTF recommendations. When the RTF TG, in turn, completed its work in 2005, it transferred its monitoring function to the ASAP.

The RTF TG determined that NASA had met the intent of all but three of the RTF recommendations. These dealt with External Tank Debris Shedding (CAIB Recommendation 3.2-1); Orbiter Hardening (CAIB Recommendation 3.3-2); and Thermal Protection System Inspection and Repair (CAIB Recommendation 6.4-1). The Task Group documented NASA's accomplishments in addressing all the CAIB recommendations, including the three outstanding ones, and further stressed that NASA's inability to fully comply with those three "does not imply that the Space Shuttle is unsafe." Furthermore, the RTF TG declined to state whether the Shuttle Program was ready to resume flight operations. Such a determination of safety



and reliability, the Task Group said, was NASA's responsibility. NASA did resume Shuttle flights on July 26, 2005 with STS-114, and to date, there have been nine Shuttle missions following the loss of *Columbia*.

When the ASAP took over the monitoring function from the RTF TG, the Panel began scrutinizing the NASA response to all 29 CAIB recommendations, as stipulated in the 2005 legislation, not just those that were designated RTF. Particular attention has been devoted, though, to the three recommendations that the Task Group designated "CAIB Intent Not Met." Accordingly, during 2007, the Space Shuttle Program Office documented for the ASAP the status of all the CAIB recommendations, but with a focus on the three that remain outstanding.

At the ASAP's fourth quarterly meeting, held at the Glenn Research Center in October 2007, John Casper reviewed Shuttle Program initiatives in response to recommendations still outstanding. Casper, Manager of the Space Shuttle Management Integration and Planning Office, described the continuing modifications to the External Tank Thermal Protection System (TPS)—modifications aimed at minimizing the risk of foam debris liberation—such as redesign of the LH2 ice frost ramps. Among the measures Casper detailed for hardening the orbiter, so that it can better sustain minor debris damage, were corner void elimination for the main landing gear doors, carrier panel redesign for the forward reaction control system, and replacing side cockpit windows with thicker panes. For inspection of the orbiter's TPS, Casper described a variety of new or enhanced techniques, such as the use of ground-based cameras and ground radar during ascent, the use of handheld infrared cameras during EVAs, and still-photo imagery taken by the ISS crew. Casper also reported on developments in TPS repair techniques, for both Reinforced Carbon-Carbon (RCC) and tile. In addition to his detailed account of the status of the three outstanding RTF recommendations, Casper provided an overview of the other 12 RTF recommendations, as well as the 14 non-RTF recommendations. For each of these, he indicated the current status of NASA's response and NASA's plans in that area. Excerpts from Casper's presentation are included in Appendix E, located on the included CD-ROM.

Christopher Scolese, NASA Associate Administrator, later updated the ASAP further on External Tank (ET) TPS modifications, orbiter hardening and orbiter inspection and repair, the subjects of the three outstanding RTF recommendations. He noted, for example, that in 2008 NASA plans to fly the first ETs that incorporate

redesigned ice-frost ramps and liquid oxygen feedline brackets. He also announced an accelerated schedule for installing new, tougher tiles (designated BRI-18) on all three orbiters in critical areas such as around the landing gear and ET umbilical doors. Scolese's letter to the ASAP appears in Appendix D.

The ASAP acknowledges all of the efforts that NASA has undertaken in response to the CAIB recommendations. The continuing achievements of the Space Shuttle Program Office, including those documented over the past year, bear out the Program's assertion that "We are moving forward with plans to ensure the continued safe operations of the Shuttle system throughout its service life." The commitment to those plans has demonstrably been preserved, even while the Space Shuttle has been called on to fly complex and challenging missions to support construction of the ISS. Furthermore, as stated in the section on Program Safety, the ASAP is gratified that the Shuttle Program continues to acknowledge the developmental nature of the vehicle and that the program remains committed to identifying and addressing risks all the way through the final Shuttle mission.

While the ASAP is satisfied with the manner in which NASA has responded to the three outstanding recommendations, the Panel continues to feel that it cannot make a final determination that would serve as the basis for closing those recommendations. As the Panel indicated in its *Annual Report for 2006*, the extensive review and analysis that would be necessary for such a determination are beyond the resources of the ASAP. The issues inherent in these open recommendations represent enduring risks, and it is encouraging to see that NASA has not lost sight of those risks. But there is also what might be called an indirect risk in those issues—if they serve to distract attention from other potential danger areas. Even while doing everything feasible to correct the failings that led to the Columbia accident, NASA would do well to guard against such distraction from hazards unrelated to that accident.

III. ASAP Recommendations and NASA Responses

A. 2007 ASAP Recommendations and NASA Responses

Observations, Recommendations, and Responses

2007 Recommendations Plus 2006 Recommendations That Are Still Open

OBSERVATION	RECOMMENDATION #	TITLE	STATUS
1	2007-01-01	Standards Programs	Open
2	2007-01-02	Exploration Safety Requirements	Closed
3	2007-01-3	Exploration risks of waiver of safety requirements	Closed
4	2007-01-04	Exploration Human vs. Robotic Review Process	Open
5	2007-01-05	Safety Fellows Program	Closed
6	2007-01-06	SMA Budget Profile	Closed
7	2007-01-07	Human Capital & Transition Planning	Closed
8	2007-01-08	Organization Chart Nomenclature	Closed
9	2007-01-09	Direction, Alignment, and Communications	Closed
10	2007-03-01	JSC SMA Training Program	Closed
11	2007-03-02	NASA Safety Reporting System	Closed
12	2007-03-03	Hazard Analysis	Closed
13	2007-03-04	Risk Matrix	Closed
14	2007-03-05	Safety Technical Authority (STA)	Closed
15	2007-04-01	Zero-base	Closed
16	2007-04-02	Mishap Investigation Reports	Open
17	2007-04-03	Issues addressed from the report of the Astronaut Health Care System Review	Open
18	2007-04-04	Office of Personnel Management with regard to compensation penalty imposed on re-employed annuitants	Open
19	2007-AR-01	Safety Culture Improvement and Monitoring (2006 Annual Report)	Closed
20	2007-AR-03	Agency SMA Budget Development Process (2006 Annual Report)	Closed
21	2006-03-02	Risk Assessment and Communication	Open
22	2006-03-03	Leveraging the Center's Safety Expertise	Open
23	2006-03-04	Random Drug and Alcohol Testing	Open

Observation #1

Lessons, such as the solar array design characteristics required for retraction, were learned during the STS-116 mission, pointing out the need to continually document these lessons and create new requirements if appropriate in the applicable standards. The engineering and safety communities have a primary duty to continue to cultivate necessary standards, updating them and keeping them alive for ongoing promulgation.

2007-01-01 Standards Programs—NASA needs to reenergize the Agency's engineering and safety standards programs to make standards current and useful and keep them as "living documents."

Response

NASA agrees that the Agency's Technical Standards Program, which encompasses the disciplines of engineering, operational safety, and quality assurance, as well as health and information technology, is an essential element in the safe and successful development and completion of the NASA mission. The Agency's Technical Standards Program encompasses not only development of NASA Technical Standards, but also support for and providing access to Voluntary Consensus Standards and other Government agency-developed standards that are used to meet NASA's programs and project requirements.

A basic tenet of the Agency's Technical Standards Program as established in NPD 8070.6, Technical Standards, is to "Use proven technical standards . . . on NASA programs, projects, and functional activities to provide an effective basis for defining requirements, evaluating proposed approaches, assessing resulting performance, and ensuring quality throughout the system life cycle."

The Agency's Technical Standards Program and the tools associated with the Technical Standards Program contained at *http://standards.nasa.gov/* were developed with the participation of all Centers to facilitate the identification and application of standards to meet the requirements of the NASA programs. These tools support both program and project standards users, as well as NASA standards developers. One significant tool that addresses the issues raised by the Panel is the feature that links individual standards and lessons learned. These tools have been effective, however, as the ASAP indicates, the Agency needs to find ways to more rapidly integrate these lessons learned into usable guidance (e.g., technical standards).

NASA has been trying to increase the responsiveness of the Technical Standards Program to program needs. As a recent example, the Office of the Chief Engineer (OCE) established a NASA interim directive that created procedures for accelerating standards development and establishing interim NASA Technical Standards. This enabled the Constellation Program to reference seven new technical standards as Constellation requirements in preparation for the Level 2 Systems Requirements Review. Development of additional standards to meet Constellation needs continues.

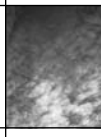
NASA agrees that the Agency's work on standards should be focused on critical priorities and keeping its needed standards up to date and the Agency is taking actions in this regard. For example, the OCE recently initiated an Agency-wide review of all new NASA standards in development and existing NASA standards under revision to determine: if the Centers support the need for the standard; that no existing standards available from other Government or non-Government sources meet the needs of the Agency's programs; and to ensure that adequate resources and management support are provided to see the development effort through to timely completion. Additionally, the OCE is developing a NASA Procedural Requirements (NPR) document that firmly establishes the basic requirements and controls for developing, approving, and updating of NASA Technical Standards. The Agency is also examining ways to strengthen the interaction with the Lessons Learned Program. The OCE and the Office of Safety and Mission Assurance agree that developing and updating standards and the tools and procedures to support them are priorities within the Agency.

Status:

Open—The ASAP plans to review the plan of action and milestones for implementing the process requirements involved with creating new standards or updating existing standards and the progress being made on establishing new and revised standards to ensure that NASA maintains standards that are current and useful.

Observation #2

The identification of safety requirements for the Exploration Program, in both a technical and probabilistic sense, is a complex, high-energy undertaking, and the public must understand that this is a difficult challenge and poses significant risk. NASA needs to be creative and innovative, while also considering (useful) legacy policy and processes.



2007-01-02 Exploration Safety Requirements

NASA should continue to develop detailed safety requirements including identifying the probability of the Loss of Crew, and track how these requirements are allocated and validated to the subsystem level.

Response

The top-level safety technical requirements, such as the probability of the Loss of Crew requirement and the failure tolerance requirements, will be captured in the Level I Exploration Architecture Requirements Document and will flow from there to the Level II Constellation Architecture Requirements Document, to Project System Requirements Documents, and into element specifications. The safety requirements will evolve into more and more detailed requirements during the flow-down process. Each of the projects (Orion, Ares, Ground Operations, Mission Operations) will also create requirements documents and Safety, Reliability, and Quality Assurance (SR&QA) Plans which will document the allocated probability of Loss of Crew requirements and contain, along with flow down, the programmatic requirements that drive the safety, reliability, and quality processes. Project-level Systems Requirements Reviews (SRRs), with close attention by the Level II SR&QA personnel, ensure the proper flow down of requirements. A planned Level II requirements review, following the conclusion of the element-level SRRs, will close the loop on proper safety requirement implementation across the program.

The integrated analysis of the probability of Loss of Crew requirement will be performed as a coordinated effort between the program and associated projects using a standardized methodology and will serve as the verification of the final probability. The standardized methodology and review and coordination at Level II will allow changes to the design and reevaluation of the probability to be performed quickly and efficiently.

Status:

Closed

Observation #3

NASA must be methodical and careful not to eliminate tried and proven methods while creating opportunities and innovations. The waiver of existing safety requirements in and of itself presents a safety risk that must be evaluated and formally accepted. The Offices of Safety and Mission Assurance and the Chief Engineer, as

the technical authorities, are responsible for formally accepting the residual risk in implementing the waiver approval process.

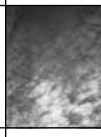
2007-01-03 Exploration risks of waiver of safety requirements

NASA should insure that incremental risk changes that are associated with Constellation's requests for waiver of mandatory NASA safety requirements currently baselined within the agency are formally approved by the appropriate technical authorities.

Response

This recommendation will be implemented through an initial requirements gap analysis. Office of Safety and Mission Assurance (OSMA) has generated a comprehensive listing of mandatory NASA safety requirements and performed an initial analysis of the requirements which would apply to the Constellation program. This listing has been forwarded to the Constellation Program SR&QA organization. All technical safety requirements will be documented in the Constellations Requirement Tracking Database (CRADLE) so it will be permanently documented and available for analysis should any of the OSMA documents undergo revision. Constellation will provide rationale for those requirements documented in the OSMA listing for which Constellation seeks an exception and these exceptions will be reviewed and approved by OSMA, Office of the Chief Engineer (OCE), and the Chief Health and Medical Office (CHMO). This will provide a baseline for assessment of any future waivers or exceptions. Currently, the Constellation Program has already entered some Technical Safety Requirements into CRADLE as part of the Systems Requirements Review (SRR) process. Further safety requirements for inclusion into CRADLE will be identified as part of the Program Baseline Synchronization at the end of the Level III SRRs.

In addition to the above rigorous process, the governance model ensures that OSMA is involved in all boards and panels at the Constellation level through the use of the Chief Safety and Mission Assurance Officer for Constellation and his alternates located at KSC and MSFC. This ensures a timely and thorough involvement in technical discussions for waivers and deviations during the life of the program. The key organization for tracking safety requirements is the Constellation Safety and Engineering Review Panel (CSERP). This panel reviews all system and element hazard analysis and hazard reports. The CSERP is responsible for verifying that failure tolerance requirements have been met. The CSERP also is responsible for



evaluating hazard reports against the programs safety requirements. Additionally, the Constellation Safety, Reliability, & Quality Assurance (SR&QA) Board is an adjunct Board to present and discuss safety requirements.

The top level safety technical requirements, such as the probability of the Loss of Crew requirement and the failure tolerance requirements, will be captured in the Level I Exploration Architecture Requirements Document (EARD) and will flow from there to the Level II Constellation Architecture Requirements Document (CARD), to Project System Requirements Documents, and into element specifications. The safety requirements will evolve into more and more detailed requirements during the flow down process. Each of the Projects (Orion, Ares, Ground Operations, and Mission Operations) will also create requirements documents and Safety, Reliability, & Quality Assurance (SR&QA) Plans which will document the allocated probability of Loss of Crew requirement and contain, along with flow-down, the programmatic requirements that drive the safety, reliability, and quality processes. Project-level Systems Requirements Reviews (SRR's), with close attention by the Level II SR&QA personnel, ensure the proper flow-down of requirements. A planned Level II requirements review following the conclusion of the element level SRR's will close the loop on proper safety requirement implementation across the Program.

Status:

Closed

Observations #4

There are two cultures at NASA: unmanned (science-oriented) and manned (exploration/transportation). The ASAP believes that there is a middle ground of trade space between the two cultures that has the potential to help manage both cost and risk and that a stronger consideration of unmanned systems is crucial to lowering risk.

2007-01-04 Exploration Human vs. Robotic Review Process

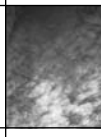
NASA should develop a formal review process to evaluate new mission proposals to ensure that optimum use is made of unmanned systems to minimize the risks of human exploration.

Response

This recommendation is written in a way that presumes a process for human mission selection that runs counter to the direction that NASA has been given and the necessary sequence of missions to achieve goals and objectives. This recommendation presumes that human missions are stand alone and selected similar to the way most science missions are competed. We, NASA, begin with the premise that there is value in human exploration. We have direction in policy based on that premise, with stated goals and objectives. The human exploration we envision is for the purpose of the following goals:

- Discovery and science in ways that are only possible through first-hand investigation and observation.
- Extending human presence off-planet and on to other planetary bodies.
- Gaining the experience and knowledge to travel and explore in ever-expanding dimensions within the solar system. The next step is to gain this operational experience on the Moon to prepare for the exploration of Mars.
- Extending our economic sphere of influence beyond Earth and low-Earth orbit.
- Bringing the excitement and experience of exploration back to people on Earth.
- Sharing these goals and the Exploration experience with other nations of the world, building on current partnerships and building new ones.

Human missions are to be based on concepts for operations being developed to address the goals above. This results in a campaign of missions with and without crew. Lunar architecture studies are conducted to develop effective and efficient operational approaches for these missions and lunar operations. In evaluating specific objectives on the lunar surface, we will take the approach that people will be utilized to the maximum extent to achieve objectives that they are uniquely needed for. Innovative system concepts and operational approaches are being studied that will minimize flight crew exposure to avoidable risks. Robotic systems will be employed to augment their capabilities and avoid these risks where possible. As we implement this approach, NASA will engineer and operate the systems with our best understanding of safety standards and will apply lessons learned from past and ongoing programs. Robotic missions and functions will be used where necessary to mitigate risks.



Status:

Open—The ASAP will continue its dialogue with NASA senior management to better understand how NASA is performing the unmanned versus manned tradeoffs and how unmanned missions in support of the Constellation Program are defined.

Observation #5

The ASAP noted that engineers are being detailed to safety to improve the status and stature of safety personnel however the safety program equivalent of the Technical Fellows Program is progressing at a slower pace than the efforts on the engineering side.

2007-01-05 Safety Fellows Program

NASA Engineering is moving forward with a robust "Technical Fellow" program to identify and empower Agency leads for all critical engineering specialties. NASA SMA should institute similar efforts to ensure that Safety Fellows are developed and empowered similarly.

Response

Executive Summary Response

NASA Headquarters, Office of Safety and Mission Assurance (OSMA), through the establishment of the NASA Safety Center (NSC), is pursuing Safety and Mission Assurance (SMA) Technical Discipline Fellows in seven discrete disciplines—system safety, reliability and maintainability, quality engineering, software assurance, operational safety, range safety, and aviation safety. These positions are embedded in the Technical Excellence functional area of the NASA Safety Center, report to the Chief, SMA, and are intended to be filled within FY08.

Outline of Detailed Action Item Response

- NSC Implementation Plan Development Efforts.
- NSC Technical Excellence Functional Area Description—including roles and responsibilities of the SMA Technical Discipline Fellows and their reporting structure.
- Plan for Staffing the SMA Technical Discipline Fellows positions.

NSC Implementation Plan Development Efforts

The NSC was formally announced on October 11, 2006. Subsequent to this announcement, working groups with members from each of the Center's SMA organizations and OSMA were established in each of the four functional areas (Technical Excellence, Knowledge Management Systems, Audits and Assessments, and Mishap Investigation Support) to develop and refine plans for establishing the NSC.

A draft plan for implementation was delivered to the Chief, SMA, on December 21, 2006, and a revised version was delivered on February 16, 2007, with suggested changes to NASA Policy Directive 1000.3, The NASA Organization, and a proposed phasing plan for FY07. Included in this set of documents is the establishment of the NASA SMA Technical Discipline Fellows positions and how they fit and relate to the Technical Excellence functional area.

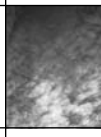
Additionally, the plans for establishment of the SMA Technical Discipline Fellows positions were shared with representatives from the Office of the Chief Engineer (OCE) during a Joint Engineering Management Board/Safety and Mission Assurance (EMB/SMA) Directors' Meeting held in Chantilly, Virginia, on February 1, 2007.

Although the NSC Implementation Plan was presented to the Strategic Management Council on April 25, 2007, funding decisions have not been finalized as of May 10, 2007. The current schedule anticipates resource decisions for the NSC will be made by July 2007.

NSC Technical Excellence Functional Area Description

The vision for the Technical Excellence functional area is to:

- Provide SMA technical excellence that supports all NASA programs, embracing the concept that SMA is an engineering discipline that enables the effective execution of all NASA programs, from concept through implementation.
- Positively influence the NASA culture within SMA and within the NASA program offices relative to the quality of SMA engineering excellence.
- Support and provide influence to ensure collaboration between SMA and other Center engineering organizations.



- Provide technical discipline support and guidance for the issues that may arise between the programs and SMA.
- Create developmental opportunities within SMA and with other engineering disciplines.

The three elements of technical excellence are: 1) discipline leads working policy, tools, and Agency coordination at Headquarters, OSMA, Safety and Assurance Requirements Division, 2) Technical Discipline Fellows, and 3) Technical Discipline Team (TDT) Leads at the NSC.

Residing within the NSC for each of the SMA disciplines will be a TDT lead. These TDT leads, working in concert with their corresponding Fellows and NASA Headquarters Safety Assurance Requirements Division counterparts, will be responsible for training and curriculum development, developing discipline boarding/qualification testing criteria, participating in the brokering of Center discipline team member participation on technical NASA Engineering and Safety Center (NESC) Super Problem Resolution Teams (SPRTs), and hosting/providing logistical support of discipline conferences and working group meetings. Currently, seven SMA technical disciplines have been defined and each will have a TDT lead in the areas of system safety: reliability and maintainability, quality engineering, software assurance, operational safety, range safety, and aviation safety.

The other foundational element of the technical excellence functional area will be the establishment of the SMA Technical Discipline Fellows. By virtue of the seniority of the individuals, the need to nurture their disciplines across the Agency and the requirement to have parity with other NASA engineering peers, the Implementation Plan proposal is for these positions to be at the Senior Technologist (ST) and/or GS-15 level. The SMA Technical Discipline Fellows will be rotational positions (current term is two years in a temporary ST or GS-15 classified position). Technical Discipline Fellows positions will be highly competitive with selections being made from the "best of the best." Each SMA Technical Discipline Fellow will be a senior person in the Agency representing excellence in each of the seven named SMA disciplines listed above. These SMA Technical Discipline Fellows will be responsible for reviewing and approving the curricula and testing/boarding criteria developed by the NSC TDT Leads. They will support OSMA as it represents the Agency externally and will engage as requested or directed by the Chief, SMA, in the highest priority technical matters for the discipline. The SMA Technical Discipline

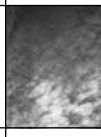
Fellows will reside at their home institution, organizationally report to the Chief, SMA, and engage in NSC matters remotely and by traveling, if necessary. The Fellows will suggest and concur in policy and standards changes that are related to their disciplines.

The SMA Technical Discipline Fellows, the TDT leads, and the discipline communities they serve will be the preferred resource pool when requests for support are received for mishap investigation support, audit and assessment support, NESC SPRT membership, NSC Discipline Working Groups and assessments, or assistance in SMA technical authority matters.

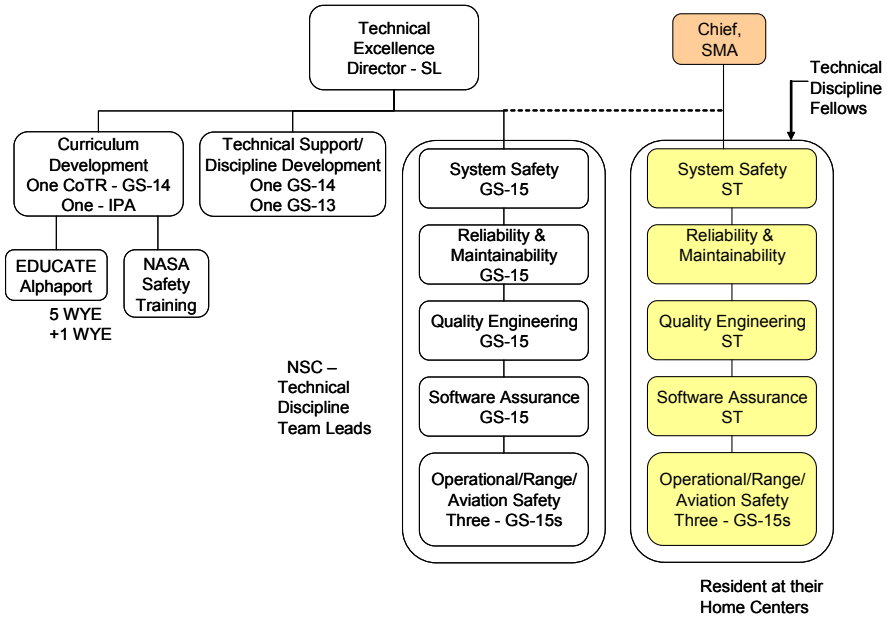
The NASA Safety Center's SMA Technical Excellence program will be modeled after the NESC and the Academy of Program/Project and Engineering Leadership to the maximum extent practical.

The SMA community being served by this Technical Excellence activity will consist of seasoned professionals, as well as newcomers to the SMA community. One of the challenges the SMA Technical Discipline Fellows (along with the TDT leads) will face is how to structure the discipline roadmaps and course offerings in ways that will serve the needs of a spectrum of student capabilities. It is also anticipated that members of industry and academia may be invited to participate as members of the TDTs to ensure that the TDT members are aware of and are using the latest tools and techniques in their professions.

The Proposed Technical Excellence Organizational Structure Chart is shown below. The implementation plan calls for the Director of the "Technical Excellence" functional activity or branch to be at the Senior Leader (SL) grade level due to the level of importance associated with this effort within the Agency. This Director, and the SMA TDT leads, will be assisted by professionals from academia and industry in the development/establishment of SMA professional curricula, on-the-job training requirements, testing/boarding criteria, and remote/distance learning training methods.



Proposed Technical Excellence Organizational Structure



Plan for Staffing the NASA SMA Technical Discipline Fellows Positions

Assuming the receipt of requested funds and complement, and contingent upon final approval of the NSC Implementation Plan, staffing for the majority of the NSC positions is scheduled to take place by December 2007. After curricula development and training activities are initiated, the SMA Technical Discipline Fellows positions will be filled during FY08.

Status:

Closed

Observation #6

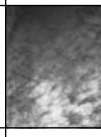
The ASAP urged caution in evaluating the impact of NASA budget problems. The budget issue has been causing concerns with regard to program cost and schedule; however all of these problems will eventually have an impact on safety.

2007-01-06 SMA Budget Profile—NASA should provide a SMA budget profile for providing adequate SMA resources to fly-out Shuttle safely and to simultaneously undertake the Constellation Program in a manner that optimizes safety.

Response

History of the SMA Budget Numbers

After the Office of Safety and Mission Assurance (OSMA) (formerly the Office of Safety, Reliability, Maintainability, and Quality Assurance) was formed in the late 1980s, NASA Headquarters attempted to maintain an accounting of resources that were applied by the various major programs for that work considered as part of the effort that the safety and mission assurances disciplines represent. This accounting was in no way an attempt to build an SMA budget for the Agency. On the contrary, the Agency has steadfastly believed that not only the management of the disciplines in support of programs and projects, but also the budgeting for their implementation should be decentralized at the Center and program level. The resources data have always been collected as a data call to the Center SMA Directors on a periodic basis and not every year. These data calls have always sought totals, including the salary costs of SMA civil service and support contractors for both direct and indirect costs, as well as a good-faith estimate of the costs of SMA content in the prime and subtier contractor workforce. While attempts were made to be all-inclusive, each dollar was not checked and cross-checked using any sort of strict accounting principles. This was not possible in the early days with the decentralized and nonintegrated accounting tools and the minimal resources invested in collecting the data. Without a well-defined work breakdown structure for NASA work, collecting the SMA budget data remains an imprecise manual task. The numbers are estimates for internal assessment and have been made available as information. In the early part of the two decades where data have been kept, the ratio of SMA dollars spent seemed to be roughly 5 percent (termed the "SMA fraction" for purposes of this paper) of the Agency budget. This has been judged, historically, to be reasonable. No budgets were ever challenged using these "rules-of-thumb," and no one has ever seriously discredited the 5 percent as being a comfortable SMA fraction.



Today and Transition

There is much unknown about any definitization of Exploration Systems Mission Directorate (ESMD) cost in the 2011–12 timeframe. Also, there are some known unknown costs in both Shuttle and ESMD operations in the 2011 and 2012 timeframes, and these will only become more apparent as we enter this year's planning, programming, budgeting, and execution (PPBE) exercise later in the spring. These plans will become more precise as new acquisitions are formalized and contracts definitized. In the meantime, all operating costs for the Shuttle in the 2011 and 2012 timeframe have been moved from the budget for the Space Operations Mission Directorate to the ESMD. An attempt to mimic this wholesale move has been made in the line for projected ESMD SMA estimated outlays.

What we do know is that the civil service workforce is fairly well understood at the summary levels and is pretty much capped by Agency ceilings. To augment SMA work that needs to be accomplished, dollars are applied as support contractor work, and investments by dollars from OSMA augment this work to some small degree. Each year, each SMA organization addresses, in an annual operating agreement, the work it needs and plans to perform. In no case have any shortfalls been identified for the OSMA to address with a mission director. Overall, OSMA, as well as SMA Directors, has been comfortable with the work levels and the resources they have been afforded for performing the work of assurance and, where there were shortages, OSMA has successfully approached responsible leaders directly with an appeal for more resources. OSMA will continue to evaluate the content of the Agency's outlay for SMA as a ratio of overall NASA outlay and will seek to use the tools brought into service by the Integrated Enterprise Management Process to better automate the insight and make these SMA fraction estimates more precise and the acceptability of resources in support of SMA more insightful.

Attachment 1, NASA President's FY 2008 Budget Request, is referenced for background information. This reflects the official budget profile for NASA.

Attachment 2, NASA Funding Estimates for Safety and Mission Assurance, is a matrix of information that explains what is known and what might be expected about SMA outlays in the present and future budget years. To use these numbers, the following assumptions and considerations must be heeded:

1) The costs of contract work for any NASA program not yet approved or conceived in the future years are undefinitized. As an illustration, the numbers of SMA

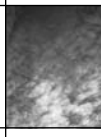
committed work provided for ESMD are the best available today. Even at that, some are missing, notably the prime costs for Level 4 Ares project (contracts are in procurement and information is embargoed). That could easily add another $10 million per year to SMA estimates. The near-term numbers are within about $10 million, which is still a significant percentage of the total. However, the story becomes much different in the later years. The out-year totals for Constellation (Cx) have not been subdivided. For example, Cx carries a budget line item for the Lunar Lander, and the run out for that number is about $7 billion. There is one for Ares 5, which also is very large. No one has attempted to subdivide that into Research Development Test & Evaluation (RDT&E) vs. SMA vs. anything else at this point, because the development has not yet begun. So, for the out years, there are large pieces missing because of a lack of contract definitization. This lack of definitization is normal, applies to all disciplines, not just SMA, and should be expected for a program that will take a decade or more to develop.

2) Any SMA costs that might accrue as a result of SOMD Cx operations activity are not yet fully scoped, and SMA costs associated with Shuttle operations are carried under an ESMD SMA projected line until fully characterized. This approach directly parallels and mimics the method of moving all Shuttle operations costs to the ESMD budget in FY11 and FY12 for subsequent allocation to either RDT&E or operations.

3) Some SMA costs may exist as part of close-outs for the Shuttle program in FY11. According to the SOMD, these are to be added in the next PPBE exercise, but these should not be significant.

4) The operations-related SMA costs for Cx operations might not be as large as the costs for Shuttle, due to the Cx objectives to lower overall operations costs, including reducing the quality insight (which is an SMA cost item) that is required for the inspection and verification of hands-on processing work. On the other hand, the money garnered from the savings in operations cost are likely to be spent on RDT&E which will require an additional SMA fraction.

5) There was little effort to capture costs other than those associated with the large human space flight programs. There is little similarity between various prime contractors' organizations to support an assumption that all SMA costs are captured equally or similarly. These costs are difficult to obtain because NASA contracts for deliverable items and does not account for the personnel costs for prime contractors.



For example, some prime contractors do most of their failure modes and effects work in their engineering organizations, while others perform such work from within their safety and mission assurance organizations. If NASA asked for estimates of prime contractor "SMA costs," the answer would not enable an "apples to apples" comparison from contractor to contractor.

Status:

Closed

Observation #7

Reference the letter from VADM Joseph Dyer, Chairman, Aerospace Safety Advisory Panel to The Honorable Michael Griffin, NASA Administrator, dated 5 April 2007, the ASAP expressed its concern that the workforce management needs be both accelerated and aligned across Headquarters and Centers. The ASAP has observed significant Human Capital planning efforts, but observed insufficient measureable action supporting these plans. The ASAP drafted nine questions to convey the ASAP's line of thinking in this area in hopes it would spark comprehensive and actionable Human Capital efforts.

2007-01-07 Human Capital & Transition Planning

NASA should coordinate its Human Capital Planning with the ongoing Shuttle/Constellation Transition Planning effort to develop an Agency-centric Human Capital Plan that balances shortages, excesses, and capabilities between, as well as within, Centers.

Response

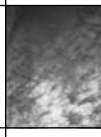
The Human Space Flight Transition Plan, baselined November 12, 2006, is undergoing significant revision at this time, with an anticipated internal completion date of late March 2007 and external release date of late June 2007. As part of this effort, the Office of Human Capital Management is working with the Exploration Systems and Space Operations Mission Directorates to develop a more comprehensive, better integrated, and up-to-date segment focused on workforce transition planning, management, and skill requirements analysis. The revision of the Human Space Flight Transition Plan—as well as its implementation—will improve the integration of the Agency's human capital initiatives with the Space Shuttle, International Space Station, and Constellation transition activities.

The human capital segment of this Transition Plan, and the human capital transition planning that it describes, will reflect a number of important initiatives NASA has undertaken over the past several months to improve the quality of workforce information and analyses available to support such planning, including identifying areas of workforce risk and misalignment. In turn, this should allow the Agency to better forecast our workforce needs and respond accordingly. NASA intends to evaluate both our civil service and contractor workforce elements; although in the short term the Agency expects the fidelity of our Government sector analysis to be more robust. However, we will solicit the assistance of our industry partners—who have conveyed a willingness to cooperatively address contractor workforce issues—in our endeavors to better capture the Agency's total workforce needs.

For example, the Johnson Space Center (JSC) conducted a Human Capital Technical Interchange Meeting (TIM) in support of Space Shuttle Fly Out and Transition on March 1–2, 2007. The purpose of this TIM was to educate the NASA Center Human Resources communities—both civil service and contractor—on the Space Shuttle work at the various Centers and contractor facilities; address Shuttle transition and retirement activities; strengthen the human capital network across organizations participating in the Space Shuttle Program; share best practices, and identify tools, processes, and approaches that are needed to address workforce issues.

Recognizing that it is critical that NASA have the ability to assess the capability of its workforce to meet mission goals and to monitor this capability over time, the Agency recently developed six measures of workforce capability— scalability, skill availability and access, performance and proficiency, sufficiency, sustainability, and utilization— that will be used to monitor multiple dimensions of workforce health at the Centers and identify areas of misalignment. These measures include an assessment of how scalable the workforce size and composition is, and needs to be, in response to changes in mission requirements such as those driven by the Shuttle/Constellation transition.

Associated with each measure are qualitative and/or quantitative indicators that are relevant to a Center's assessment of its workforce relative to that measure. These indicators will be further refined over the coming months so that more precise metrics are associated with each measure, with many of them ultimately obtainable from existing or enhanced Agency systems. The measures can be used individually to describe specific areas of misalignment, but are intended to operate as a set to



demonstrate the overall "health" (or capability) of a Center's workforce and indicate potential tradeoffs that may be necessary to meet particular workforce objectives. The first cycle of assessments will occur this spring, as part of the FY 2009 Planning, Programming, Budgeting, and Execution (PPBE) process and updated annually as a regular part of the PPBE process. This information will allow the Agency to be better prepared to take the actions necessary to mitigate actual and potential workforce misalignments.

Concurrent with this effort, the Agency made a significant enhancement to its ability to analyze workforce data necessary to support effective workforce planning. In the past, the Agency had the ability to view and analyze workforce data categorized by organizational elements (Centers and organizational subdivisions). The data included employee position information (e.g. occupations, pay grades) and workforce demographics (e.g., age, years of service, education levels, retirement eligibility date). This capability produced multidimensional reports and analyses, typically focusing on Center employment levels, attrition rates, competency profiles, shifting demographic and occupational trends, and likely impacts of buyouts. Although such data was helpful for many purposes, it had limited utility in the context of program and project transition because the data could not be analyzed by programs and projects. This has now changed, and workforce analyses can be conducted based on an expanded set of dimensions and measures, listed below:

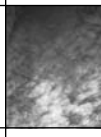
KEY DIMENSIONS	KEY MEASURES
Program and Project	Full-time equivalent (FTE) burn rate
Center and Directorate	Average Age
Education Level	Average Years of Service
Retirement Eligibility Date	Average Grade
OPM Occupational Series and Grade	Labor rate per FTE
NASA AST Classification	Labor cost for project
Competencies	Overtime factor
Pay Period (showing trends)	

The dimensions drill down to increasing detail, and any dimension can be combined with another to analyze any measure. This means, for example, that the Agency can analyze the distribution of FTE and/or competencies for the Constellation Program across all Centers by any of the projects; determine the retirement eligibility dates for employees assigned to the Shuttle Programs (or Shuttle projects), and perform many other analyses relevant to transition planning. In March 2007, these new Workforce Information Cubes will be rolled out to Headquarters Mission Directorates and Program Managers across the Agency (as well as to human resources and labor analysts).

An important metric of the human space flight program transition activity is the workforce sharing and migration among programs as work continues on the Space Shuttle and International Space Station Programs and accelerates on the Constellation Program. During FY 2006, initial workforce sharing metrics were generated by the Space Shuttle Program to measure the shifts of JSC civil service employees in their support of multiple programs. These metrics are being expanded to the Kennedy Space Center (KSC) and Marshall Space Flight Center. The civil service metrics will be evaluated this summer as we examine how to develop similar metrics for the industry workforce based on contractually provided information.

To enhance the Agency's ability to locate needed competencies efficiently and accurately and use the workforce as effectively as possible, employee competency profiles in the NASA Competency Management System were recently established. Employees updated their competency profiles to indicate the competencies they have acquired in their career as well as their depth of expertise in each competency. This information was then validated by their supervisors.

The Agency successfully conducted a limited pilot study of a modeling and event simulation software tool (Micro Saint), co-developed and used by the Department of Defense at the Kennedy Space Center's Launch Control Center during 2006. As a result, the Office of Human Capital Management is working with the Exploration Systems and Space Operations Mission Directorates to employ this tool more broadly to enable scenario planning to be effectively incorporated into transition activities. We are reviewing a proposal for a 2007 implementation in support of transition workforce analysis needs. We will provide more information on this activity as it becomes available.



Finally, it should be noted that in January 2007, in response to the recognition of the criticality of workforce planning to the success of the Vision for Space Exploration, the Agency's first Workforce Planning Governance Structure was established and endorsed by the Strategic Management Council and the Operations Management Council. The Governance Structure is composed of key management officials from across the Agency who, in collaboration with the human resources community, will identify Agency workforce risks and surface such risks to senior management, develop solutions to workforce issues that have an Agency-wide impact, and contribute to the overall improvement of workforce planning.

The ASAP has monitored the program's progress in presentations received by the ASAP in July and October 2007 and February 2008 and notes that outstanding progress is being made.

Status:

Closed

Observation #8

Several program and project presentations given at the 2007 first quarterly meeting suggested a lack on emphasis relating to the implementation of the Technical Authority infrastructure as evidenced by its absence or lack of consistency on program and project organizational charts.

2007-01-08 Organization Chart Nomenclature

NASA should standardize the nomenclature used in organization charts for Programs and Projects, and ensure that all organization charts include the required Technical Authorities as part of their structure. There should be consistency in the use of the titles given to elements of the organization charts (e.g., SMA vs. SR&QA vs. SRM&QA).

Response

NASA agrees that adding information on the organization charts for programs and projects to identify the individuals serving as the technical authority for engineering, for safety and mission assurance, and, where appropriate and warranted, for health and medical authority, will assist in identifying and accelerating the acceptance of this concept. Also, where changes to the nomenclature of the Agency's organizations might reduce some confusion and provide some standardization for these elements

within the Agency, these will also be changed. While this recommendation focused principally on safety and mission assurance (SMA) nomenclature for organizational charts, NASA expanded the response to include a discussion of engineering and health and medical organizational nomenclature as well.

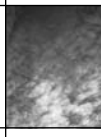
I. Safety and Mission Assurance Nomenclature

a. Programs and Projects

NASA Procedural Requirement (NPR) 7120.5D, NASA Space Flight Program and Project Management Requirements, requires decision paths that graphically describe the chain of accountability and decision paths for each project and program's organization. A graphical illustration of the organization (such as an organization chart) is to identify the technical authorities that are to serve as elements of the program's governance structure. These graphical illustrations are an essential part of the program's plan within the section where the program's authority, management approach, and governance structure are described in detail (per reference subparagraph 1.5, paragraph E.3, Appendix E, Program Template, NPR 7120.5D, NASA Space Flight Program and Project Management Requirements) and are to use the nomenclature specified in NPR 7120.5D. NPR 7120.5D is sufficiently clear on this matter and as program organizations begin to comply with the requirements, this element of the recommendation will be fulfilled.

For the three program offices that have embedded safety and mission organizations, a variety of names exist: for the Constellation Program, the embedded SMA organization is called the Constellation Safety, Reliability and Quality Assurance Office; for the International Space Station Program, it is the ISS Safety and Mission Assurance Program Risk Office; and for the Space Shuttle Program, it is the Space Shuttle Safety and Mission Assurance Office.

It is more important that the organizations that are independent from the program and from which the SMA technical authority derives have a common nomenclature. These organizations are the Center Safety and Mission Assurance organizations and are described in the next section.



B. Institutional Organizations

Regarding the recommendation for a consistent nomenclature for the SMA organizations in the Agency, there is presently no policy directive that requires NASA Center conformance or contractual requirement for the Jet Propulsion Laboratory, which is a contracted Federally Funded Research and Development Center (FFRDC) that requires conformance. Several years ago, the OSMA fostered the idea for standardizing the names of the Center safety and mission assurance organizations where appropriate. According to a survey NASA conducted after it received the ASAP recommendation on nomenclature, only Ames Research Center's (ARC) safety and mission assurance organization departs from the convention, and it is a minor departure. ARC's departure includes the entity "environment" in its organizational name which indicates that a substantial portion of its responsibility includes environmental protection. Not all safety and mission assurance organizations are assigned this role. For this reason, NASA believes the nomenclature for the safety and mission assurance organizations, which serve as the operating base for the Agency SMA technical authority, is compliant with the ASAP recommendation.

II. Engineering Nomenclature

A. Programs and Projects

See explanation provided in first paragraph of section I a. of this response which applies equally to all three technical authorities (engineering, safety and mission assurance, and health and medical authority).

In 7120.5, NASA allowed variations in the title for Program and Project Chief Engineers to not break agreed-to personnel grade structures. All Program and Project Engineering Technical Authorities have the term "Engineering" in their titles (e.g., Program Chief Engineer, Project Chief Engineer, Lead Project System Engineer, Project Systems Engineer, and Project Lead Engineer). Also, large programs can have a "Systems Engineering & Integration" or "Systems Integration" office and associated nomenclature to cover the integration function for that program.

B. Institutional Organizations

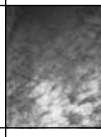
NPR 7120.5D states the following:

> "The Center Director (CD) appoints, with the approval of the NASA Chief Engineer, individuals for the position of Center Engineering Director (or equivalent) and for the Engineering Technical Authority positions down to and including Program Chief Engineers and Category 1 Project Chief Engineers (or equivalents). The CD appoints Category 2 and 3 Project Chief Engineers and Lead Discipline Engineers. (On some programs and projects, the program- and project-level Engineering Technical Authority may also serve as the program/project Systems Engineering Manager or Systems Engineering and Integration Manager; in these instances, the Program/Project Manager concurs on the appointment of the Engineering Technical Authorities.)"

> "Program/Project Chief Engineer (PCE)—The PCE (or equivalent as per footnote below—'Centers may use an equivalent term for these positions, such as Program/Project Systems Engineer') is the Engineering Technical Authority for the program/project and is the single point of contact for the engineering technical authority process within the program/project. In executing this role, the PCE works with the Center Engineering Director(s) (or designees), as necessary, to ensure the engineering technical authority direction provided to the program/project reflects the view of the Center engineering community (or NASA engineering community, where appropriate)."

All Centers have eliminated their Chief Engineer's office, with the exception of ARC and the Dryden Flight Research Center. These Centers were permitted to maintain these offices due to Center size and the unique nature of their missions (note that the ASAP has indicated that this was an acceptable rationale).

As for the titles, the most important feature is that all Engineering Directorates include "Engineering" in their titles. Recall that each directorate at each Center has slightly different functions based upon work content and size—therefore, NASA will reevaluate the nomenclature as it applies to these differences as NPD 1000.3, The NASA Organization, is resolved.



III. Health and Medical Nomenclature

a. Programs and Projects

See explanation provided in first paragraph of section I a. of this response which applies equally to all three technical authorities (engineering, safety and mission assurance, and health and medical authority).

b. Institutional Organizations

In developing the implementation plan for Health and Medical Technical Authority (HMTA), the Office of the Chief Health and Medical Officer is striving to be consistent with the OSMA and the Office of the Chief Engineer. This includes adopting similar nomenclature and procedures, where appropriate, given the unique nature of HMTA. The details of HMTA implementation will be contained in a NASA Procedural Requirement, currently in draft, will facilitate consistency of implementation across institutional organizations.

Cost and Safety Benefit

The actions related to standard nomenclature for organizations discussed in this response were, for the most part, already accomplished, and only the remaining increment that will be changed might result from the ASAP recommendation. The cost of this proposed implementation is negligible as is the impact to safety benefit. The changes that will be instituted for placing the identified technical authorities for programs and projects on organizational charts will be of negligible cost and will have the benefit of ensuring that the technical authorities will be consulted on affected decisions.

Status:

Closed

Observation #9

The implementation of the technical governance model has been a challenge for NASA, which has focused its initial efforts on developing the overarching policy and procedures followed by reassigning responsibilities, identifying subject matter experts, and transferring people—all of which then entails training and communications so that the technical authority model is understood by everyone at all levels of the organization.

2007-01-09 Direction, Alignment, and Communications

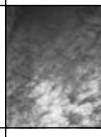
NASA should implement a consistent process to provide Technical Authority direction, alignment, and communications to ensure that the working level of NASA is fully informed on Technical Authority. Provide the Panel with feedback on the effectiveness of its implementation.

Response

NASA supports the goal of ensuring that all affected or involved personnel understand and support the implementation of Technical Authority as introduced in NPD 1000.0, Strategic Management and Governance Handbook and further specified in NPR 7120.5D, *NASA Space Flight Program and Project Management Requirements*. NASA also recognizes that the new governance model and the recently revised provisions for Technical Authority in the Program and Project requirements represent fundamental and important changes within the Agency. As a result, a number of actions have been taken, and more are planned to ensure the success of this vital part of the NASA check and balance system. This response, framed around the ASAP recommendation, will discuss these actions.

Consistent Process for Technical Authority Direction

- The process for implementing Technical Authority will be formally defined and is currently consistent with NPR 7120.5D and will be consistent with the issuance of NPR 1000.0.
- A foundation of Technical Authority is clearly defined roles and responsibilities. Technical Authority is delegated to individuals at various levels of the organization and flows from the Administrator down to the institutional technical organizations as appropriate.
- The roles and responsibilities of the individuals having delegated Technical Authority at each level are spelled out at a high level in the Agency requirements and will be more completely defined in Center implementation plans approved by Headquarters and in associated Center procedure documents.



Alignment[1]

The Technical Authority process has been designed and specified so that the individual serving as the Technical Authority can function independently and has clear authority.

By definition, those with delegated Technical Authority are funded independently from programs and projects to ensure their independence.

The process ensures that the Technical Authorities have timely access to information and involvement in processes important to the management of requirements, the review and deliberation of issues, and adjudication of dissenting opinions that may arise.

To accomplish this NPR 7120.5 specifies:

- The responsibilities of the Technical Authorities include:
  a. Approving changes to and waivers of all Technical Authority-owned requirements. The Technical Authority is responsible for assuring that changes to and waivers of technical requirements are submitted to and acted on by the appropriate level of Technical Authority.
  b. Serving as members of program/project control boards, change boards, and internal review boards. (NPR 7120.5D Paragraph 3.4.1.1)
- The day-to-day involvement of the Technical Authorities in program/project activities as members of the program or project's control, change, and internal review boards ensures that:
  a. The Technical Authorities remain current and knowledgeable of issues facing the program or project and the context of these issues, and
  b. Any significant views of TAs will be available to the program/project in a timely manner and should be handled during the normal program/project processes. (NPR 7120.5D Paragraph 3.4.1.2) The process for implementing Technical Authority recognizes that the ultimate responsibility for program/project success in conformance with governing requirements remains with the Program/Project Manager. (NPR 7120.5D Paragraph 3.4.1.2)

1 Alignment—Dictionary definition: The positioning of something for proper performance

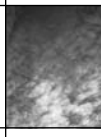
- The process also recognizes that circumstances may arise when a Technical Authority or the Program/Project Manager may disagree on a proposed programmatic or technical action and judge that the issue rises to a level of significance that the next higher level of management should be involved. (NPR 7120.5D Paragraph 3.4.1.3) The process specifies that resolution should be attempted at successively higher levels of Programmatic Authority and Technical Authority until resolved. Final appeals are made to the Office of the Administrator. (NPR 7120.5D Paragraph 3.4.1.2. c.)

The above is not an exhaustive explanation of how the Technical Authority process positions those delegated with this responsibility to carry out the intended check and balance in an effective and efficient manner. Merely having a sound defined process, while necessary, is not sufficient. The following discussion of communications and follow-up completes the picture.

Communications

In recognition of the importance of Technical Authority and in acknowledgement that this is not the first attempt at implementing Technical Authority, an extensive communications plan will be employed to ensure that everyone in the Agency affected by or involved with Technical Authority understands the concept, the Agency's expectations for Technical Authority, and how the process will be implemented.

The development of NPR 7120.5D which invokes Technical Authority for space flight systems was a major year-long effort that involved a large team with representatives from every Center. The objective of this effort was to ensure that the development of the requirements for program management and its tie to Technical Authority involved active participation of the representatives of those who would be affected. This development effort was instrumental in obtaining acceptance of a revised program and project management process which includes the specified Technical Authority process. In addition, the Engineering Management Board (EMB) has been instrumental in developing Technical Authority so the engineering community leadership is capable of promulgating the concept within their Centers. Future EMB meetings will focus on the message and its delivery to ensure consistency with NPR 7120.5D.



Similarly, the NASA Aerospace Medicine Board (AMB) and NASA Medical Policy Board (MPB) have been involved in the development of the Health and Medical Technical Authority process, and will facilitate communication through promulgation of the Health and Medical Technical Authority concept to NASA Centers. Likewise, the Chief of Safety and Mission Assurance has been communicating with the SMA Managers across the Agency on the methods and processes for the SMA technical authority implementation.

Additional communications and actions that are planned and in development include:

- The Chief Engineer has conducted all-hands briefings at Centers explaining the Technical Authority concept.
- A two-day session of the Program/Project Management Board (March 5 and 6, 2007) devoted to ensuring additional key Program and Project personnel from each Center and Mission Directorate understand the provisions of NPR 7120.5D which include Technical Authority, handling of dissenting opinions, and handling of changes to and waivers of requirements.
- A rollout presentation to personnel at all Centers by the Chief Engineer, the Chief, Safety and Mission Assurance, and the Chief Health and Medical Officer. This presentation includes the Agency's expectation, strategic governance concepts, the basic concepts of NPR 7120.5D, Technical Authority implementation, the process for handling dissenting opinions, etc. The presentation also will preview the standard training material to be used at the Centers to ensure uniform Agency-wide understanding.
- The Chief Engineer and the Chief, Safety and Mission Assurance will include discussions/town meetings on the subject of Technical Authority during their routine visits to the Centers. In addition, the Chief Health and Medical Officer is briefing and soliciting feedback regarding the Health and Medical Technical Authority concept throughout the NASA health and medical community. These meetings will provide opportunities to address questions or concerns that individuals may have, and will also provide Headquarters with feedback on the level of understanding and acceptance of Technical Authority.

- The Technical Fellows program will play an important role in supporting Technical Authority. The Technical Fellows will provide leadership for their respective discipline areas and for specific technical standards. They will interpret, approve changes to and waivers of their standards, and support Center Lead Discipline Engineers and SMA Managers and the Program, Project, and Sub-system Chief Engineers and Chief Safety and Mission Assurance Officers. They will also have an important role in providing technical advice, assuring the health of and providing stewardship for their discipline, and communicating applicable policy and procedures.
- It should be noted that since the ASAP meeting, the Administrator has approved the plan for the Technical Fellows program. The Chief, Safety and Mission Assurance, is presently reviewing the implementation plan for the NASA Safety Center which will also embody a concept for technical fellows in support of the system safety, reliability and maintainability, and quality engineering disciplines.
- The Health and Medical Discipline Experts serve as the Health and Medical Technical Authority (HMTA) corollary to the Technical Fellows program. Health and Medical Discipline Experts provide leadership for their respective area and technical authority expertise for specific technical standards. In their role, they interpret and recommend changes and/or waiver of the appropriate health and medical standards to the HMTA Center Chief Medical Officer, and will be a key resource for HMTA Center Chief Medical Officers, and the Program, Project, and Sub-system Managers. They will also have an important role in providing technical advice, assuring the health of and providing stewardship for their discipline, and communicating applicable policy and procedures.
- To ensure that the required understanding of concepts and Agency expectations, the Academy of Program/Project & Engineering Leadership (APPEL) will include Governance, Technical Authority, dissenting opinions, principles governing changes and waiver of requirements in selected training courses. This would specifically include the training program given to new hires and mid career engineers and project mangers.
- POLARIS, the Program/Project Online Library and Resource Information System will provide anyone on the NASA network with information on

management processes and requirements. It provides a one-stop shop for access to:

- A searchable, sortable database of all requirements in NPR 7120.5
- An exportable compliance matrix of all NPR 7120.5 requirements
- Project life cycle diagrams with reviews
- Project review definitions with products
- Templates and examples of products
- Project standard WBSs with dictionaries, and requirements for implementation and approval
- NPR 7120.5 deviation and waiver form and instructions

This resource provides more relevant information than can be listed here. A link is currently being developed to provide information related to Technical Authority including roles and responsibilities, process, and requirements, training material, and points of contact.

- The Office of Chief Engineer intends to use the NASA Engineering Network's Program/Project Management Community as a means of supporting the understanding and acceptance of Technical Authority. The network will post high-level information about Technical Authority with appropriate links to detailed sources. It will also provide a repository for answers to frequently asked questions. These questions will also identify areas that are not understood and need to be addressed in training or by management.

Feedback

NASA plans to obtain feedback on the understanding and acceptance of the Technical Authority process by several means.

- As mentioned above, discussions held during normal Center visits by key Headquarters personnel and the scope and nature of questions being asked about Technical Authority will be used as a gauge of the effectiveness of the rollout process as well as the Technical Authority process itself.
- Individuals with delegated Technical Authority at each level for each of the three technical authorities will communicate to the Chief Engineer, Chief, Safety and Mission Assurance, and/or Chief Health and Medical Officer on a regular basis, and will be requested to flag issues or concerns related to the implementation of Technical Authority in these communications.

- The OCE plans to perform periodic audits of Center implementation of NPR 7120.5D, including the provisions related to Technical Authority, handling of dissenting opinions, and changes to and waivers of requirements. Over the long-term these audits will formally assess the effectiveness of Technical Authority implementation and identify associated trends and need for systemic corrective action.
- The Chief Health and Medical Officer receives updates regarding the status of Health and Medical Technical Authority implementation on a quarterly basis from the Center Chief Medical Officers, including the provisions related to Technical Authority, handling of dissenting opinions, and changes to and waivers of requirements. Over the long-term these reports will formally assess the effectiveness of Health and Medical Technical Authority implementation and identify associated trends and need for systemic corrective action.

Cost and Safety Benefit

The actions discussed in this response are planned and are not the result of the ASAP recommendation. Therefore, there is no direct cost and safety benefit attributable to this response.

Status:

Closed

Observation #10

The ASAP looked favorably on the well-developed JSC training plan to establish basic, mid-level, and advanced training, which seemed a little more specific than what the ASAP has seen across the Agency particularly in correlation to journeyman and advanced levels for instance. Another good feature of the JSC plan was formal succession planning as expertise moves on or retires, identifying potential SMA candidates from within and outside the SMA organization.

2007-03-01

JSC SMA training program and instruction should be shared with other Centers, the NASA Safety Center, and OSMA in pursuing a goal of providing Agency-wide safety training. JSC's high-quality training program may provide a good basis for standardization.

Response

The JSC SMA Director briefed an overview of the JSC SMA Personnel Qualification Program (PQP) at NASA's Agency SMA Directors' meeting on September 27, 2007. JSC also provided the PQP Plan to the Technical Excellence Office at the NASA Safety Center (NSC). The NSC has already analyzed and incorporated the best characteristics of the PQP into its Agency-wide SMA Technical Excellence (TE) planning and products. For example, the concepts of workforce gap analyses, core competencies, workforce qualifications profiles, and benchmarking have all been incorporated into the Agency-wide SMA TE planning. The NSC also examined the core courses that are available under the PQP, which included both SMA Discipline and Domain (e.g., Shuttle, Station) courses, and included them in the collection of candidate course models available for Agency-wide technical excellence applications. Further, the NSC balanced the PQP input against other SMA TE activities, such as those found in the Marshall Space Flight Center Professional Development Roadmaps and against various best-practices found in industry and independent discipline certification entities (such as the Certified Safety Professional program). The NSC will distill and integrate all these SMA TE initiatives and use them as content for the Agency-wide SMA TE initiative.

Status:

Closed

Observation #11

As witnessed by the ASAP member in attendance at the STS-117 readiness reviews, the Program Authority and Safety Technical Authority did not appear to have insight into the title, content or actual assessment conducted to address the NASA Safety Reporting System (NSRS) reports. This approach is taken to protect the confidentiality of the individual making the report since the NSRS allows for anonymous reporting of problems, issues and concerns that may affect safety. The ASAP felt it appropriate that they provide some level of oversight into the integrity of the evaluation process and results.

2007-03-02

OSMA should provide an overall summary and analysis of the NASA Safety Reporting System (NSRS) reports, actions taken, evaluation results, and resultant changes made as well as any other supporting documentation that substantiates the integrity of the NSRS evaluation process.

Response

Timely information about actual or potential safety problems is critical to NASA's success. We rely on our entire workforce, civil service and contractor alike, to notify management or the local safety office, through normal reporting channels, of any issues regarding safety. Sometimes normal reporting channels are just not enough, especially for people who do not feel that their locally-reported concern was addressed adequately, or who, for whatever reason, fear retribution or are not comfortable speaking up publicly. That is why we have the NSRS. The NSRS is a supplemental reporting system that NASA employee or contractor employee working in support of NASA may use to anonymously report safety hazards directly to OSMA. Enclosed is a program overview that summarizes the basics of how the IVSRS is set up and operates.

We essentially promise every NSRS report author two things: 1) that we will promptly investigate their concerns, and 2) that we will do so in a way that will shield their identity and protect their anonymity. Any anonymous reporting system like the NSRS is only as good as its reputation. Members of the NASA workforce who believe they cannot report hazards openly will not use the NSRS if they do not have the trust and confidence that we will protect their anonymity and promptly investigate their reports. Every new NSRS report we receive is a validation that the author believes in the integrity of this system—and that is our most important metric of program integrity.

Because the NSRS program is committed to protecting NSRS author identity in perpetuity, in practice we extend that protection to the content of the reports we receive, our investigative findings and our dispositions because we never know what NSRS information, when combined with other publicly available information, might inadvertently lead someone to discover the identity of an NSRS author. We classify and treat NSRS information as Sensitive But Unclassified (SBU) and deny public access to NSRS information citing Freedom of Information Act exemptions from release. Because of those program policy restrictions, this response does not include any specific references to actual NSRS report cases, dispositions, or metrics. Due to the sensitive nature of the information requested, the Headquarters OSMA will be briefing the ASAP members on NSRS program operations in greater detail, to include a more comprehensive review of the volume and frequency of reports received, actions taken, and program evaluation metrics at the next face-to-face ASAP meeting scheduled for February 2008.

NSRS oversight is provided on a day-to-day basis by the NSRS Program Manager. The OSMA Deputy Chief and Division Directors assist the NSRS Program Manager with the initial screening and determining of appropriate investigative paths for every incoming NSRS report. They also are asked to personally review and concur on the investigative findings, corrective actions, and readiness for report closure. Additional oversight of the NSRS program is provided by the NASA Office of the Inspector General (OIG), which audits the NSRS process and report files on a periodic basis. NASA OIG agents are given unobstructed, read-only access to all closed NSRS report files stored in our NSRS archives. Their findings are discussed with OSMA leaders and changes, in the form of continual improvements, are made to the program as appropriate.

Status:

Closed

Observation #12

The Constellation program requirements were based totally on Agency requirements without yet incorporating system-unique features. The program will be doing a functional hazard analysis soon, which is a good thing, and the results can be retrofitted into specifying other requirements.

2007-03-03

The Constellation program should initiate the development of an early hazard analysis in order to define program and project system-specific safety requirements.

Response

NASA concurs and accepts the recommendations of the ASAP. This key analysis has been embraced since Program inception because of Constellation's strong leadership focus on safety and risk. Hazard and risk analysis form the foundation of the Program under the leadership of the Constellation Manager and is used to frame system-specific safety requirements. Additionally, hazard and risk analyses continue to evolve to meet the needs of the Program and are often improved based upon lessons learned, historical human spaceflight systems safety design practices, and a roadmap that is integrated throughout the key milestones of Constellation. The Program's hazard and risk analysis effort is also broad based, receiving contribution and insights from all venues relating to requirements and design to include program and project level boards and working groups.

The Constellation Program has interjected system safety analysis beginning with concept development. This has continued, and has been tailored, to meet the Program's needs during requirement's development and into systems definition. Safety analysis will continue to be important through preliminary and critical design and into flight readiness. At each point, safety and hazard analysis will inform the design and planning process. Of special note is the concept of a "functional hazard analysis" which has been developed to aid in top down hazard allocation, mission quantitative model development, and better linkage between these and other analyses. It begins with a top down review of each reference mission in the Program, identifies hazards within each phase that can be allocated to the architecture and system level, and results in a powerful tool used to integrate all the various risk and hazard analyses, both quantitative and qualitative. This, in turn, leads to better and early design insight.

In summary, the Constellation program endorses the recommendation of the ASAP and will continue to employ early hazard and risk analysis. To date, these analyses have informed and shaped safety requirements at Program levels I, II, and III, and clearly indicate that Constellation has a robust and effective early hazard effort that spans concept development to flight readiness.

Status:

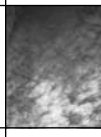
Closed

Observation #13

Constellation has a significantly improved risk matrix than that used for the Shuttle Program to identify, quantify, and communicate risk. It categorizes risk by levels of management, increasing the level of management required for accepting increased levels of risk.

2007-03-04

NASA should adopt the improved risk matrix approach developed for the Constellation program Agency-wide. The ASAP also suggested improved definitions associated with quantification thus providing a basis for NASA to allocate resources to the most significant hazards.



Response

In principle, NASA agrees with the intent of the recommendation, which is aimed at introducing uniformity and transparency into risk communication and acceptance practices across the Agency. However, the strategy of adopting a standard risk matrix has to be evaluated in the context of the broader risk management process that NASA is developing to address and integrate all types of Agency risk, including safety, performance, cost, schedule, and institutional.

NASA is currently improving its risk management practices in order to strengthen the technical basis for its decision-making. Refinement of the risk matrix concept is within the scope of this effort which involves updating and re-writing the NASA Procedural Requirements (NPR) 8000.4, Risk Management Procedural Requirements. The existing NPR 8000.4 addresses, primarily, program and project risks but not the entire spectrum of risks indicated above. Addressing this broader spectrum will require a broader and holistic risk management framework for the Agency and the establishment of a set of requirements that are consistent with this framework. The revised NPR 8000.4 is intended to accomplish this and is planned to be supported with procedural handbooks that describe how these requirements should be implemented. The revised NPR 8000.4, targeted for release as a draft in January/February of fiscal year 2008, is planned to include the following features:

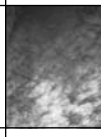
- Broadening of the scope of the risk management process to include infrastructure and institutional risk considerations.
- Implementing the Agency's "Baseline Performance Review" initiative to improve management oversight of project cost, schedule, and technical performance. This is in response to a Government Accountability Office audit report entitled "High Risk Series: An update." [1]
- Using more analytical and quantitative techniques to assess safety and technical risks. This is presently reflected in the content of several specific NASA requirements and procedural documents (e.g., NPR 8705.5 and NPR 871 5.3).
- 1. GAO-07-3 10, "High-Risk Series: An Update," January 2007, available at *http://www.gao.gov/new.items/d073l0.pdf*
- Developing a top-down risk control process that is based on collective consideration of different, relevant risk types including safety, performance, cost, and schedule. This was recommended by a NASA-sponsored safety study team.

- Implementing ASAP Recommendation number four (2006-03-02): "The ASAP recommends that a comprehensive risk assessment, communication and acceptance process be implemented to ensure that overall launch risk is considered in an integrated and consistent manner. The process should be sound, mature, consistently implemented to yield high confidence and consistent results that are generally accepted by the majority of the community."
- Adhering to a set of principles for risk assessment, risk management, and risk communication to comply with a recent memorandum from the Office of Management and Budget (OMB) and the Office of Science and Technology Policy.

The risk matrix is a graphic tool used to represent and categorize risk contributors according to likelihood (frequency or probability) and consequence (severity), and thereby to elevate risk contributors for appropriate management attention and action. The risk matrix is not an analysis tool; its legitimate use is as a tool for communication of the results of analysis. It has been widely used for a variety of purposes, some of which fit and some of which do not fit the intended application purpose. The matrix will have a role in the enhanced risk management process being developed. The strategy of using a suitably defined and broadly applicable Agency-level risk matrix for risk management fits into the process being envisioned and could be a part of the enhanced risk management tools being developed.

At present, even though risk is controlled at the program or project level, there is no Agency- level risk control strategy. This void is being addressed in the current effort to update NPR 8000.4. An Agency-level risk control strategy would provide consistent risk assessment and risk categorization across all programs and all Agency-level applications. It would also provide a consistent scheme to elevate appropriate risk contributors to higher levels within the Agency for appropriate action. One Agency-level risk matrix would be used to categorize and elevate risk contributors. Consistent techniques would be used to assess the likelihood and consequences of risk contributors. Risk uncertainties would also be assessed for uncertainty categorization and management.

An Agency-level risk control strategy would not replace risk control strategies at the program level. Instead, an Agency-level risk control strategy would establish a consistent risk management process at the Agency level. Using advanced risk



assessment and risk ranking techniques, similar or dissimilar program risks could be consistently compared and be traded- off within an Agency strategy. Risk contributions across programs could also be accumulated to obtain the total risk incurred. Those particular risk contributors would also be escalated using appropriate criteria to require an Agency-level response. In these evaluations, risks would be separately categorized according to the particular type of consequence involved to allow comprehensive, multi-attribute assessments.

2 U.S. Office of Management and Budget (OMB), Memorandum for the Heads of Executive Departments and Agencies, Updated Principles for Risk Analysis, September 19, 2007, available at:
http://www.whitehouse.gov/omb/memoranda/index.html

NASA believes that the risk management improvements that are underway address the ASAP recommendation in this regard and enable the Agency to develop a defensible, consistent approach to evaluate and manage the entire spectrum of institutional, programmatic, and technical risks.

Status:

Closed

Observation #14

The ASAP in reviewing the Safety Technical Authority (STA) for the Constellation Program noted that the roles and responsibilities of the STA were concerned with assuring that the analyses was thorough and proper and that the management level accepting the risk was at the right organizational level. The STA does not document their independent objective assessment of the risk. This marked the first time the ASAP had seen an attempt to clarify the difference in roles and responsibilities as differentiated by programs and projects versus STA.

2007-03-05

Roles and responsibilities for the Safety Technical Authority (STA) at the program and project level should be expanded to include an independent assessment to verify that the risk is properly characterized and also giving advice on the acceptability of the risk.

Response

The implementation of Technical Authority process was discussed at a recent joint meeting between the Office of the Chief Engineer (OCE) Engineering Management Board and the Agency Safety and Mission Assurance Directors. As a result of those discussions, the Office of Safety and Mission Assurance (OSMA) will request a change for the next revision of NPR 7120.5D, Chapter 3, on Safety and Mission Assurance (SMA) Technical Authority, which will expand the roles and responsibilities of the SMA Technical Authority to include assessing that program/project risks are properly characterized and providing advice on the acceptability of those risks.

Status:

Closed

Observation #15

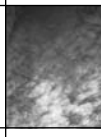
In the past, NASA vehicles have been designed and certified for human rating by complying with the NASA system design requirement that "no two failures shall result in crew or passenger fatality or permanent disability." An alternate approach, driven by the need to reduce weight, is being applied in the development of the Constellation Program. The ASAP needs to understand the issues and concerns addressed in the NASA review process in affirming whether adequate justification exists for this alternate approach.

2007-04-01

The ASAP requests that NASA provide a briefing on the "zero-based" approach being applied to manage the safety/weight/cost trades of the Constellation elements and explain how this approach assures an acceptable level of cumulative risk and provides adequate justification for implementing this alternate approach.

Response

A briefing was given at the first quarterly meeting of 2008 at KSC, FL. The JSC presentation addressed the Orion mass scrub process that resulted in the preliminary design point of departure architecture. The presentation included an overview of the mass scrub assumptions and methodologies employed to identify the potential targets for system reductions and the rigorous analytical decision process that was employed to select all the features of the final configuration on the basis



of crew safety and other risks, system reliability, operational flexibility, and overall mission success. The approach to risk leveling, and how probabilistic risk assessment modeling techniques were utilized to identify risk and assess the mitigation of risk as design decisions are made were also presented. The presentation also provided updates on the point of departure configuration refinements that had been introduced based on continuing studies.

Status:

Closed

Observation #16

The ASAP learned that the last serious incident that occurred at GRC was a fire in January 2006 and that the report of the mishap investigation board was completed but was still under review at NASA Headquarters.

2007-04-02

NASA Headquarters needs to provide for more timely completion, review and release of major mishap investigation reports, utilizing the support of the NASA Safety Center if needed. Such increased emphasis on expeditious handling of the investigation findings will ensure that the lessons learned from the investigation are disseminated throughout the Agency as soon as possible, to correct unsafe conditions and help prevent a recurrence of the mishap.

Status:

Open—The ASAP is awaiting a NASA's response.

Observation #17

The ASAP found that the report of the Astronaut Health Care System Review Committee that was established following the widely publicized arrest of astronaut Lisa Nowak in February 2007 contained a number of valuable recommendations in areas such as the astronaut selection process and the need for open communication between senior leadership and flight surgeons, trainers and astronauts. At the same time, the ASAP is concerned that many of the beneficial results from the Committee's review are being obscured by one issue; reports of excessive alcohol use by astronauts in the preflight period.

2007-04-03

The ASAP requests NASA to provide the Panel with a briefing on the issues that will be addressed from the report of the Astronaut Health Care System Review Committee. The briefing should include the plans for addressing those issues, as well as the timeline for closing them out. The ASAP requests periodic updated status reports until closeout.

Response:

NASA's letter of 15 August 2007 from Ms. Shana Dale, the NASA Deputy Administrator, to VADM Joseph Dyer, Chair, Aerospace Safety Advisory Panel, provided information regarding actions NASA is taking to implement many of the recommendations provided in the report of the Astronaut Health Care System Review Committee. The following actions will be taken based on the Committee's recommendations:

- Enhance use of behavioral health data in the astronaut selection process
- Ensure that flight surgeons, trainers, and astronauts understand the many avenues they have to communicate concerns of flight safety to senior leadership and encourage such communication
- Adopt a formal code of conduct for the astronaut corps
- Provide regular training to flight surgeons to all astronauts on their personal status with regard to medical qualification for space flight assignments
- Enhance a program of external peer review of NASA's medical and behavioral health staff
- Establish one credentialing and privileging authority for both flight medicine and behavioral health providers, with documented process for accountability
- Institute behavioral health assessments in conjunction with annual astronaut flight physicals

There are several other medical, including behavioral health, recommendations that require further review as they are complex and long-term in nature. These recommendations have to do with health care system management, communication,

and linkages within a biomedical research and aeromedical/occupational health care system, and implementation of enhanced psychological screening.

The Space Life Sciences Directorate at Johnson Space Center (JSC), led by Dr. Jeff Davis, is taking the lead on responding to the recommendations regarding behavioral and medical health, with the oversight of the Chief Health and Medical Office, Dr. Richard Williams, and the oversight of the NASA Medical Policy Board (MPB). The MPB, which consists of senior physician representatives from NASA and other Federal agencies, recommends NASA medical policy and guidance for human space and atmospheric flight. Dr. Davis's organization is developing a plan for initial response/disposition of each recommendation (including those we will accept and those we will examine further) and will present that plan at an initial meeting of the MPB on August 21 at NASA Headquarters.

Additionally, senior management at JSC is reviewing the recommendations related to communication, trust, organization, and process issues. Dr. Ellen Ochoa, Director of Flight Crew Operations, along with others, is preparing a confidential survey for astronauts and flight surgeons to examine these and other issues in more detail. This will be invaluable information from which to chart a path forward.

The October 2007 presentation to the ASAP by Mr. Bryan O'Connor, NASA Chief Safety and Mission Assurance Officer, provided information concerning NASA's investigation to determine if there was any substance to allegations of reports of excessive alcohol use by astronauts in the preflight period. The investigation included an anonymous climate survey among active astronauts, flight surgeons, and others in the Astronaut Office. About 65 percent of employees in that office responded to the survey, which appears to be a good response given that the results will be subject to Freedom of Information Act requests and other possible public disclosure. The investigation did not substantiate specific instances of preflight use.

Status:

Open—The ASAP will schedule a status presentation during its visit to JSC in 2008.

Observation #18

In discussion relating to Workforce and Human Capital and the loss of skilled personnel to retirement at GRC, the ASAP reminded NASA that it is at disadvantage in offering renewed employment to Federal retirees because those returning

employees face a compensation penalty under rules of the Office of Personnel Management. Those rules can be waived for retired Federal employees who are hired by the Defense Department.

2007-04-04

NASA should seek a waiver from the Office of Personnel Management with regard to the compensation penalty imposed on reemployed annuitants. The OPM rules put NASA at a serious disadvantage in its ability to retain personnel who are eligible to retire or have retired, particularly where the agency is in competition with the Department of Defense, which has been granted such a waiver. This is a major concern for the Marshall Space Flight Center in Huntsville, AL. The DOD's Army Materiel Command and Ballistic Missile Defense Agency are to be relocated to the Redstone Arsenal, near Marshall, creating several thousand anticipated technical openings in the Huntsville area.

Status:

Open—The ASAP is awaiting a NASA response.

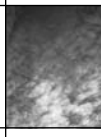
Observation #19

It was reported by the ASAP in its Annual Report for 2006 that despite receiving some positive observations, the ASAP believes that NASA still has much to do in its efforts to develop and retain a positive safety culture. For instance, individual Center survey results still show concern in the Agency with upward communication and management support. Also the ASAP is concerned that NASA may reverse its positive course.

2007-AR-01

Safety Culture Improvement and Monitoring recommendation from the ASAP 2006 Annual Report—National Aeronautics and Space Administration (NASA) must:

- Continue to positively influence and measure safety culture at every level within the Agency
- Include on-site contractors in measuring, reporting and enhancing employees' safety culture



- Standardize its approach to measuring safety culture within the Centers
- Routinely brief NASA's most senior leaders on changes in the Agency's safety culture

Response

NASA agrees with the intent of the panel's recommendation. There are two components to this recommendation: 1) improving safety culture across the Agency (including contractors), and 2) measuring and communicating safety culture using a standard process. Our activities in relation to each of these components are summarized below:

Improving Safety Culture across the Agency

It is widely recognized that improvement in safety culture can be derived from improvements in the safety climate. The safety climate of an organization is defined by many factors, including technical knowledge and behavior of its members with regard to safety. This includes opportunities for personnel exposure to safety principles and practices, dissemination of safety lessons learned, the ease of safety communication up and down the organization, and the consideration of safety in management decisions.

NASA is pursuing a multi-faceted approach for improving the safety climate across the Agency. This approach is based on:

- Integration of safety management with programmatic and engineering decision
- Processes
- Achieving technical excellence in safety and mission assurance activities

The former is being implemented through NASA's governance model. The latter is being addressed by establishing the NASA Safety Center (NSC) to expand and strengthen NASA's safety training element of its safety program. Each approach is briefly discussed below:

NASA Governance Model

Over the past several years NASA has been defining and implementing an overall governance model that is based on responsible decision making, a balance of power, and the establishment of checks and balances. These elements and the practices are

a direct outgrowth of the Columbia Accident Investigation Board's findings, and establish a framework for a safety culture to grow and thrive. These three elements permit ongoing lively discussion and debate to occur unfettered at all levels within the NASA organization. The Administrator set the overall tone for these discussions and debates by consistently challenging decisions and established policies while looking for new ways to answer questions. Additionally, NASA has codified a formal process for dissent in NASA Procedural Requirements 7120.5D, NASA Space Flight Program and Project Management Requirements. The visibility and clear definition of the overall decision process, along with the examples of these processes set at the highest level of the Agency in the Program Management Council and other top-level councils, establish the benchmark for the rest of the Agency to follow. Nevertheless, NASA recognizes that, even with these concepts documented and regularly exercised, there will be people who remain uncomfortable even in the most open of organizational safety climates. Some of that lack of comfort might be attributed to a lack of technical competency or standing among one's peers, or from lack of confidence in the openness of management. As discussed in the following paragraphs, NASA is taking steps to increase the competence (and confidence in the competence) of the NASA workforce relating to safety and mission assurance disciplines through the Technical Excellence activities, and is also developing the capability to measure the overall climate with respect to safety.

Achieving Technical Excellence in Safety and Mission Assurance Activities

NASA is committed to increasing the awareness and concern for safety at all levels from facility operations to flight operations including system safety in design. Increased excellence and awareness in safety are necessary ingredients for strengthening our safety culture. The Technical Excellence Program being developed at the NSC will conduct educational programs to raise safety awareness, safety lessons learned, and the safety emphasis of NASA management and staff. Safety engineering and management courses that are being planned will address not only safety in the operational and design environment but also philosophy and doctrine that influence the various management and technical levels at NASA. We believe that the envisioned Technical Excellence Program will not only increase the safety competency of our workforce but will also increase management's awareness of the benefits that derived from sound safety management and safety engineering principles and processes being applied uniformly across the Agency. These training programs will be made available to NASA's contractors in accordance with NASA Policy

Directive 3410.2E, Employee and Organizational Development, paragraph 1.h, which states that it is NASA policy to permit NASA contractor personnel to attend authorized and scheduled NASA training, provided that space is available and such attendance is of benefit to the Agency.

Measuring and Communicating Safety Culture Using a Standard Process

Recognizing the importance of safety culture, the Office of Safety and Mission Assurance (OSMA), over the past two years, has developed and maintained contacts with several faculty members of the Naval Postgraduate School (NPS) and the University of California at Berkeley (UCB) who have developed a Web-based safety climate survey tool for the Naval Aviation School. Recognizing the difficulty inherent in measuring safety culture, this tool uses safety climate metrics as an indicator of cultural strengths and weaknesses. After several exchanges of information and views between the OSMA and the NPS/NCB faculties, it was decided that a proof-of-concept should be undertaken to demonstrate the feasibility of using a similar tool at NASA. The Goddard Space Flight Center (GSFC) volunteered to participate in project were presented to OSMA. OSMA is currently evaluating the results of this study and is planning to conduct a series of additional pilot studies. These studies will allow OSMA to incrementally arrive at an Agency-wide safety culture shaping and measurement process that will be effective for both design and operational environments NASA. OSMA is also investigating whether this process will allow NASA on-site contractors to participate on a voluntary basis; contractor participation may be dependent on the specific contract. To this end, the following activities are being pursued by OSMA:

- Examine the results of the GSFC study, and past safety culture assessment and shaping processes performed at NASA, as well as in other government and nongovernment organizations, to determine best practices and analyze what practices could be adapted for NASA use.
- Develop a safety culture assessment and shaping process, or adapt a currently employed process for NASA use that incorporates the applicable government and industry best practices. This process will include methods to educate Center leadership on the process, measure safety climate, analyze the survey data, and advise NASA Headquarters and Center leadership as to the results and recommended strategies to strengthen safety culture.

- Implement another pilot program at selected NASA Centers using the process developed above.
- Develop and begin the implementation of an Agency-wide culture assessment and shaping process. OSMA plans to complete the above activities by the end of fiscal year 2008. The Agencywide culture assessment and shaping process is intended to be implemented iteratively.
- NASA believes that our safety culture initiatives are responsive to the ASAP recommendation.

Status:

Closed

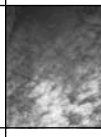
Observation #20

The ASAP Annual Report for 2006 cited several problems in estimating NASA resource requirements for SMA for the present and future budget years and also in assessing how the budget is being expended.

2007-AR-03, Agency SMA Budget Development Process

NASA should:

- Standardize and centralize its SMA budget development and allocation based on predefined mission requirements identified by Centers and programs, as validated by OSMA.
- Require explicit itemization of safety-related expenditures and shortfalls, to be reported quarterly, by all organizations and programs within the Agency.
- Require OSMA, in conjunction with the Comptroller and the Office of Program Analysis and Evaluation, to conduct quarterly reviews of programmatic safety requirements versus budget authority, for the purpose of ensuring that safety issues are being addressed and identifying critical risks.
- Require OSMA to validate to the Administrator, on a quarterly basis, that the proper level of budget authority has been provided for Centers and programs to fulfill safety objectives and to minimize risks, consistent with other institutional needs.



Response

NASA agrees with the intent of the panel's recommendations regarding the SMA budget and will continue to execute or initiate the following actions:

In its program planning, budgeting, and execution (PPBE) process, NASA will continue to identify and substantiate the content of the SMA effort that constitutes the work performed by the Office of Safety and Mission Assurance (OSMA) in its general and administrative (G&A) element of the NASA budget to include the salaries of the personnel in the OSMA, the NASA Safety Center, and the NASA Independent Verification and Validation Facility in West Virginia and any procurement or other civil service salary resources associated with its work.

In its PPBE process, NASA will continue to ask each Center to identify the SMA staff resources required within the Center Maintenance and Operations (CM&O) account as also further detailed and defined in each Center's SMA Annual Operating Agreement (AOA). This will include the institutional safety effort as well as the SMA technical authority components of this account.

NASA will provide guidelines in the current PPBE cycle addressing the need for the Mission Directorates to include SMA content in explicit form as part of their planning process. This will include not only the directly funded civil service content but also any associated support contract effort included in their directly funded efforts. The Mission Directorates will also be asked, to the extent possible, to identify the direct account money that is to be allocated to the SMA-related tasking on any program or project developing or operating NASA hardware. The content will include the work that is performed under the NPR 7120.5D, NASA Space Flight Program and Project Management Requirements, Appendix G4 work breakdown structure and that work that is included in the NPR 7120.5D, Appendix F template for projects that include an SMA plan (paragraph F3.2) (for space flight projects covered by this directive). In brief form, this planning information would include planning for resources that will be spent for entities including safety, reliability, quality, software assurance, and SMA management assessment activity.

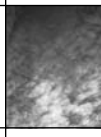
It is anticipated that the planning information will be reviewed as part of the PPBE process and approved as part of the official budget submission to the Office of Management and Budget. Shortfalls and risks will be addressed as part of this review process and as part of the development and approval of Center SMA AOAs formulated and approved each year.

As these budgets are approved and the execution begun, the Chief, Safety and Mission Assurance will maintain contact with the Center SMA managers to assure that work expectations are properly covered and that shortfalls are not detrimental to the mission.

As voting members of the Program Management Council (PMC), OSMA, the Office of Program Analysis and Evaluation, and the Comptroller will review the resource expenditure for SMA activities for programs during the monthly Agency PMC to assure that the plans for SMA activities are being met and to address any shortfalls in achieving objectives. The exact content for these reviews will need to be developed in further detail, but doing this review monthly as part of the Baseline Performance Review (nee State of the Agency review) will enable a focus on each element of the Agency on a rolling basis. If the Administrator is not present at these reviews, the Chief, Safety and Mission Assurance, will advise the Administrator separately of the acceptability of program budget authority and resource availability that is reviewed.

A similar review of SMA budget authority and plan execution will need to be incorporated into the Operations Management Council (OMC) review of the Centers. Until this review process is developed, the Chief, Safety and Mission Assurance, will use his authority for reviews and audit to assess the execution status of the Center SMA AOA and the development of the Agency budget for CM&O. This assessment will be the basis for his certification of the adequacy of SMA resources to the Administrator and Deputy Administrator.

NASA is working an allied concern that has been registered by the General Accounting Office, which relates to improvement needed in the high-risk area of contract management. Part of this concern stems from a present lack of a means for effectively monitoring NASA contract performance. Although this impacts more than the tasks, the OSMA is involved with this team to assure that SMA performance is part of the ongoing effort to review, analyze, and potentially reengineer NASA's contractor performance monitoring process to ensure that needed data elements are available for effective contract management, performance monitoring, and Agency financial management. This will eventually help the Agency monitor performance in SMA as well as other important facets of contract management.



Status:

Closed

Observation #21

It was observed in 2006 that with regard to risk assessments that are being made to support launch decisions, it appears that a series of fragmented, nonstandardized tools and methodologies are in use. A lack of confidence in the technical basis for the assessments also appears to sometimes exist, and variations in risk matrix definitions among programs have been observed.

2006-03-02 Risk Assessment and Communication

The ASAP recommends that a comprehensive risk assessment, communication, and acceptance process be implemented to ensure that overall launch risk is considered in an integrated and consistent manner. The process should be sound, mature, consistently implemented to yield high confidence and consistent results that are generally accepted by the majority of the community.

A letter request from the NASA Administrator to the ASAP dated 13 Sept 06 requested that the ASAP investigate this area.

Response:

During 2007, the status of efforts in this area has been assessed through the many program and project presentations the ASAP has received over the past year. Sound application of risk assessments has been seen in recent planning and presentations of new policy being developed and for several new major programs including Constellation (Reference Recommendation 2007-03-04 for instance).

Status:

Open—The ASAP will undertake a review of Agency policy, requirements and guidance; training in this area, and communication issues to determine where more standardization can be achieved.

Observation #22

During our meeting at Kennedy Space Center in 2006, the ASAP noted that KSC's new Fall Protection Program is very comprehensive and well-designed and represents an exemplary effort.

2006-03-03 Leveraging the Center's Safety Expertise

The ASAP recommends that the KSC Fall Protection Program be promulgated across all Centers, with local modifications as appropriate. The ASAP further recommends that other Center be tasked to develop similar programs for other elements of the NASA Occupational Safety Program, such as trenching/shoring, lockout/tagout, confined space entry etc. individual centers can be developed as centers of excellence for individual program areas and serve as a resource for all NASA activities. This would provide best of class programs for all of NASA without duplication of effort by the Centers.

Response:

During 2007, the final draft of the KSC Fall Protection Program policy document was staffed through KSC procurement so as to coordinate the draft policy with KSC contractors. Concurrently, the final draft KSC policy has been coordinated with the other NASA Centers in developing an Agency-level fall protection policy. Cost implications reported by the KSC contractors are now being analyzed and reviewed in finalizing the contractual requirements applicable to KSC contractors, which ten need to be reviewed for application to the other Center's contracts.

Status:

Open—The ASAP will receive an updated briefing to assess latest progress.

Observation #23

During our meeting at the Kennedy Space Center in 2006, the ASAP noted that recent mishap investigation revelations indicate that there does not seem to be an Agency-wide requirement for random drug and alcohol testing among contractors.

ASAP 2006-03-04, Random Drug and Alcohol Testing

Recent mishap investigation revelations indicate that there does not seem to be an Agency-wide requirement for random drug and alcohol testing among contractors. ASAP recommends that expanding both random pre-incident and targeted post-incident testing would be well advised for contractors as well as NASA civil servants.

Response

We are committed to providing a safe and secure working environment. Consistent with that commitment, NASA has the authority to, and in fact does, mandate testing programs covering both the civil service and contractor workforce.

With respect to the civil service workforce, we recently enhanced our drug testing policy to increase the percentage of the civil service population subject to testing, to expand the range of substances for which testing is done, and to increase the frequency of testing. Similarly, as required by the Government-wide Federal Acquisition Regulations (FAR), we require our contractors to establish and maintain a program for a drug-free workplace (with exceptions for contracts with a value of less than $100,000 or for the acquisition of "commercial items"). In addition, the NASA FAR Supplement (NFS) requires contractors to conduct a broad range of drug and alcohol testing of contractor employees engaged in specific designated positions and includes provisions for preemployment, random, and post-accident testing. As discussed in more detail below, contracting officers are required to insert the appropriate NFS clause in all solicitations and contracts containing the clause at subpart 1852.246-70, "Mission Critical Space Systems Personnel Reliability Program," and in other solicitations and contracts exceeding $5 million in which work is performed by an employee in a sensitive position.

In particular, NASA realizes that we have a legitimate interest in determining the cause of serious accidents (including, the employment of post-accident drug testing) so that we can undertake appropriate corrective actions. In spite of the existence of these policies, regulations, and procedures, several recent investigations have highlighted that, at a minimum, the requirements for (and perhaps the importance of) post-mishap testing for drugs and/or alcohol were not sufficiently clear to those in charge of Incident Response Teams and to others responsible for mishap investigation and follow-up. Further investigations at the Kennedy Space Center, site of two of the most recent incidents, and elsewhere, have confirmed that the Agency does not seem to have an adequate mechanism for enforcing or verifying contractor compliance with drug and alcohol program and testing requirements.

In order to respond fully to the ASAP'S recommendation, as well as to comments and recommendations made in subsequent interactions with the ASAP and its members on this topic, the following response addresses current policies governing the civil service workforce; contractual requirements that cover NASA's substantial

contractor workforce; and the specific actions that we propose to take to clarify and strengthen related policies and procedures, particularly with respect to post-mishap testing.

Civil Service Workforce - Policies and Procedures

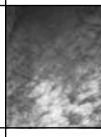
NASA Procedural Requirements (NPR) 3792.1, Plan for a Drug-Free Workplace, documents NASA's policy for, and implementation of, a drug-free workplace. NASA's authority to promulgate the policies and procedures contained in NPR 3792.1 derives from several sources, most notably Executive Order 12564,Drug-Free Federal Workplace (signed on September 15, 1986); Public Law 100-71, enacted on July 11, 1987 (Section 503 addresses the implementation of Executive Order 12564); and the Civil Space Employee Testing Act of 1991, 42 U.S.C. § 2473c.

In accordance with these laws, it is NASA's policy to ensure a workplace that is free of illegal drugs and to provide opportunities for the rehabilitation of employees when appropriate. Accordingly, NPR 3792.1 is designed to deter the use of illegal drugs and emphasizes:

- The opportunity for counseling, assistance, and rehabilitation to an employee who is using illegal drugs.
- Treating an employee with personal dignity and respect for his/her privacy when drug testing is necessary.
- A "Safe Harbor" provision; i.e., an employee who voluntarily identifies himself/herself as a user of illegal drugs to his/her supervisor, who attends and successfully completes an appropriate counseling or rehabilitation program, and who remains drug-free thereafter will not be disciplined.

While it is our intent to help an employee overcome drug-related problems, illegal drug use will not be tolerated. We recognize that a drug-free workplace can best be achieved when personnel participate in a comprehensive drug-prevention program. Our program, therefore, includes the following types of drug testing:

- Preemplovment Testing. Testing, as a condition of employment, any applicant tentatively selected to fill a Testing Designated Position (TDP). (TPDs are established in concert with guidance from the Interagency Coordinating Group [ICG] Executive Committee, which works under the authority of the Office of National Drug Control Policy. Appendix B of NPR 3792.1 provides a detailed description of the criteria that must be



met in order for a position to be determined to be a TDP. Revisions to the list of TDPs must be cleared by the Department of Justice and approved by the ICG Executive Committee.)

- Random Testing. Unannounced testing of an employee in a TDP selected on a random basis.
- Reasonable Suspicion Testing. Testing of any employee based on observable phenomena, an arrest or conviction for a drug-related offense or criminal investigation, information provided by a reliable/credible source or independently corroborated, or new evidence that an employee tampered with a previous test result.
- Accident or Unsafe Practice Testing. Authorized testing of an employee because of an accident or unsafe practice that occurred on the job and caused or may have contributed to serious injury or death of another or damage to Government or personal property.
- Follow-Up Testing. Unannounced testing of an employee who successfully completes rehabilitation for illegal drug use.
- Voluntary testing. Unannounced testing of an employee who is not in a TDP but who volunteers to be included in the pool from which employees are selected for random testing.

On October I, 2006, NASA updated NPR 3792.1 by implementing the following changes in policy and procedure:

- Preemployment Testing. Preemployment testing now covers current NASA employees not previously subject to random drug testing but who are tentatively selected to move into a TDP.
- Testing for Additional Substances. In the past, NASA has only tested for marijuana and cocaine (except in unique circumstances) as required by regulation. The Agency has expanded testing to cover phencyclidine (PCP), amphetamines, and opiates.
- Additional TDPs. Approximately 6,000 positions, or one-third of NASA's total civil service workforce, are now identified as occupying TDPs.
- More Testing. Twenty-five percent (up from 10 percent) of employees occupying TDPs will now be randomly tested for illegal drug use four times per year.

Pursuant to authorities established within NPR 3792.1, the Assistant Administrator for Human Capital Management is responsible for ensuring the implementation of drug-related policies and procedures affecting the civil service workforce, as well as for designating the Agency's Drug Program Manager. Line supervisors play important roles in the effective implementation of these policies and procedures, including identifying positions that shall be subject to random testing (i.e., TDPs), requesting reasonable suspicion tests, requesting post mishap testing, and initiating appropriate disciplinary action.

Contractor Workforce - Requirements

NASA's contractor-related drug and alcohol policies and procedures also stem from multiple sources, including Government-wide Federal Acquisition Regulation (FAR) provisions and NASA-specific legislation. The FAR clause on maintaining a drug-free work environment requires contractors, within 30 days after award, to publish a statement notifying its employees that the unlawful manufacture, distribution, dispensing, possession, and or use of a controlled substance is prohibited in the contractor's workplace and specifying actions that will be taken against employees for violations of this prohibition. In addition, the clause requires contractors to establish an ongoing drug-free awareness program and provide all employees engaged in performance of the contract with a copy of the statement noted above. Failure to comply with these requirements may render the contractor subject to suspension of contract payments, termination of the contract, and suspension or debarment. In addition, the NFS (as documented at 48 CFR parts 1823 and 1852), implements the Civil Space Employee Testing Act of 1991, which requires the Administrator to establish a program to conduct preemployment, reasonable suspicion, random, and post-accident testing of contractor employees responsible for safety-sensitive, security, or national security functions for use, in violation of applicable law or Federal regulation, of alcohol or a controlled substance. Specifically, NASA also inserts the following clause in all solicitations and contracts subject to the Mission Critical Space Systems Personnel Reliability Program and in other solicitations and contracts exceeding $5 million in which work is performed by an employee in a sensitive position (except for solicitations and contracts for commercial items):

"The Contractor shall institute and maintain a program for achieving a drug- and alcohol-free workplace. At a minimum, the program shall provide for pre-employment, reasonable suspicion, random, post- accident, and periodic recurring

(follow-up) testing of contractor employees in sensitive positions for use, in violation of applicable law or Federal regulation, of alcohol or a controlled substance. The Contractor may establish its testing or rehabilitation program in cooperation with other contractors or organizations."

As used in the NFS, "employee in a sensitive position" means a contractor or subcontractor employee who has been granted access to classified information; a contractor or subcontractor employee in other positions that the contractor or subcontractor determines could reasonably be expected to affect safety, security, national security or functions other than the foregoing requiring a high degree of trust and confidence; and includes any employee performing in a position designated as "mission critical" (as defined elsewhere in the NFS). The term also includes any applicant who is interviewed for a sensitive position.

To give contractors flexibility in tailoring their programs to test for the controlled substances that pose the greatest threat to safety, security, or national security, NASA allows its contractors to test for a wide range of controlled substances in addition to the two mandated drugs (i.e., marijuana and cocaine).

Failure to comply with the requirements of the FAR clause described above to maintain a drug free workplace may lead to suspension of contract payments, termination of the contract for default, and debarment and suspension of a contractor. In addition, such actions can be taken if there becomes "such a number of contractor employees in sensitive positions having been convicted of violations of criminal drug statutes or if there is substantial evidence of drug or alcohol abuse or misuse occurring in the workplace as to indicate that the contractor has failed to make a good faith effort to provide a drug- and alcohol-free workplace" (48 CFR § 1823.570-4(b)).

Actions to Address ASAP Recommendation

Such policies and procedures notwithstanding, multiple recent mishap investigations (as noted by the Panel) have indicated that, at a minimum, the Agency and its on-site managing contractors have not been taking full advantage of existing authorities to test for substance abuse in the post-mishap environment, thereby missing important opportunities to potentially determine the full root cause of these accidents and institute appropriate corrective measures. Further, additional investigations by the Office of Human Capital Management, the Office of Procurement, and the Office of Safety and Mission Assurance, as well as by various organizational

components at the Kennedy Space Center, have identified several areas that require action on the part of the Agency, including:

- Inadequacies in Post-mishap Procedures. NASA's procedural Requirements for mishap and close call reporting, investigating, and recordkeeping are documented in NPR 8621.I. In general, requirements and procedures for post-accident drug and alcohol testing are incorporated by reference to NPR 3792.1. Several shortcomings to this approach have been identified:
  - First, since NPR 3792.1 only pertains to NASA's civil service workforce, no information is available to accident response or post-accident investigation teams regarding appropriate policies and procedures for testing of contractor or subcontractor employees.
  - Second, NPR 3792.1 states that "an employee may be subject to testing" (italics added), leaving room for substantial interpretation on the part of responsible officials.
  - Third, NPR 3792.1 implies that the determination of whether or not to test is the responsibility of the supervisor. It is not clear from the NPR who else, if anyone (e.g., an Incident Commander), has the authority to order post-mishap testing in the event that the supervisor is not available (or otherwise unable) to make that determination.

Lack of Verification/Enforcement of Contractor Programs

As detailed above, both Government-wide and NASA-specific guidance governs the establishment of substantive drug- and alcohol-free workplace programs for most NASA contractors. There does not appear, however, to be an adequate Agency-wide mechanism for reviewing contractor programs either to enforce compliance with the contractual requirements or to assess the efficacy of their respective efforts.

To address these issues, NASA will:

- Revise and Clarify Post-mishap Testing Requirements. Multiple actions will be taken to improve post-mishap procedures and gather additional data on the role of substance abuse in accidents and other mishaps.
  - The Office of Safety and Mission Assurance, working with the Office of Procurement and the Office of the General Counsel, will revise NPR 8621.1 B to specifically address the clarification of procedures and imposition of requirements for post-mishap testing of contractor and subcontractor employees [ASAP 2006-03-04-b].

- Changes in this area may require revisions to NASA's procurement regulations. In particular, and as part of this action, we will also assess whether or not to extend its current testing provisions to solicitations and contracts valued at less than $5 million.
- In parallel, the Office of Human Capital Management, working with the Office of Safety and Mission Assurance and the Office of the Human Capital Management, working with General Counsel, will revise NPR 3792.1 B. We will 1) evaluate expanding the number of individuals who have the authority to require post-accident testing, 2) clarify the requirements for conducting such testing, and 3) specify the circumstances, if any, in which testing might be broadened to include alcohol [ASAP 2006-03-04-c].
- In the course of these revisions, the Office of Safety and Mission Assurance and the Office of Human Capital Management will ensure that their respective policies and procedural requirements are consistent with each other.
- The Office of Human Capital Management will ensure that supervisory training addresses post-mishap testing procedures and authorities [ASAP 2006-03-04-d] and, similarly, the Office of Safety and Mission Assurance will ensure that mishap investigation training addresses post-mishap testing procedures [ASAP 2006-03-04-e].

• Institute a Contract Requirements Compliance Surveillance Effort. The Office of Procurement, working closely with the Office of Safety and Mission Assurance and the Office of the General Counsel, will institute a process to review the status of plans and any associated metrics in order to establish whether the contractor is compliant with the existing requirements related to a drug- and alcohol-free workforce [ASAP 2006- 03-04-f). As part of this action, NASA will expand its requirements for contractor testing to cover phencyclidine (PCP), amphetamines, and opiates to ensure closer conformance with the requirements that apply to the civil service workforce. Based on the outcomes of any review, NASA may issue revised guidance to contractors in an effort to stimulate improvements in the efficacy of drug- and alcohol-free programs designed to establish or maintain a safe and productive work environment.

As appropriate, additional organizations will be consulted or involved in the implementation of these actions, including the Office of the Chief Health and Medical Officer and the Office of Security and Program Protection.

Recognizing that the formal completion of these actions may require some months and, that mishaps may occur in the interim, the Agency will take immediate steps to ensure that NASA is fully utilizing its existing authorities with respect to post-mishap testing and investigations. Data derived from increased testing, as well as from other sources, will help provide a basis for evaluating and determining additional actions that must be taken to strengthen the Agency's posture with respect to substance abuse prevention. At a minimum, the Assistant Administrator for Human Capital Management and the Chief, Safety and Mission Assurance, will issue interim policy guidance and notify their respective communities that post-mishap drug sting will be mandatory for civil service employees associated with Type A and Type B mishaps. [ASAP 2006-03-04-g]. (Note that the Agency continues to have the authority to test, and will test as appropriate, in certain circumstances; i.e., instances where an "accident results in damage to Government or private property estimated to be in excess of $10,000." This authority, therefore, extends to Type C and most Type D mishaps, as well.)

In summary, NASA policy has been strengthened for illegal drug use for civil servants including testing for more substances., increasing the percentage of positions to be tested (now 1/3 of the workforce) including pre-employment testing of current NASA employees selected for positions designated for testing, and mandatory testing of civil servants associated with Type A and B mishaps with authority extended to all mishaps as appropriate. Several possible actions for contractors included the need to clarify post-mishap testing requirements in existing drug-free policies for safety sensitive, security, and national security functions, extending current contractual provisions to contracts less than $5M and including additional substances, and implementing increased verification and surveillance efforts with results providing the driver for additional efforts.

Status

Open—ASAP will receive an updated briefing in 2008 to assess progress in implementing the illegal drug use policy and in developing an alcohol use policy.

IV. Appendices

Appendix A: Charter of the Aerospace Safety Advisory Panel

1.0 OFFICIAL DESIGNATION

This charter sets forth the purpose for the Panel officially designated as the Aerospace Safety Advisory Panel, originally established under Section 6 of the National Aeronautics and Space Administration Authorization Act, 1968, as amended (P.L. 90-67, codified at 42 U.S.C. § 2477). The Panel was reauthorized in Section 106, Safety Management, Section 6, of the National Aeronautics and Space Administration Authorization Act of 2005, (P.L. 109-155). Further, the NASA Administrator hereby renews and amends the Panel's charter, pursuant to the Federal Advisory Committee Act (FACA), U.S.C. App. §§ 1 et seq.

2.0 PURPOSE AND DUTIES

2.1 The Panel shall draw on the expertise of its members and other sources to provide advice and make recommendations to the NASA Administrator on matters related to safety.

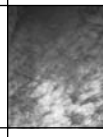
2.2 In accordance with 42 U.S.C § 2477 (as reauthorized in 2005), the Panel shall review safety studies and operations plans referred to it, including evaluating NASA's compliance with the return-to-flight and continue-to-fly recommendations of the Columbia Accident Investigation Board, and shall make reports thereon, shall advise the NASA Administrator and the Congress with respect to the hazards of proposed or existing facilities and proposed operations with respect to the adequacy of proposed or existing safety standards, and with respect to management and culture related to safety. The Panel shall also perform such other duties as the NASA Administrator may request.

3.0 REPORTING

The Panel will function in an advisory capacity to the NASA Administrator, the Congress, and through the NASA Administrator to those organizational elements responsible for the management of the NASA safety and mission assurance activities.

4.0 PANEL ORGANIZATION AND SUPPORT

4.1 Panel Members: In accordance with 42 U.S.C. § 2477 (as reauthorized in 2005), the Panel will consist of a maximum of nine members who will be appointed by the NASA Administrator. Members will be appointed for six-year terms. Members shall receive compensation as authorized in the NASA Authorization Act of 2005. Most members will serve as Special Government Employees (SGEs).



4.2 Panel Chairman: In accordance with 42 U.S.C. § 2477 (as reauthorized in 2005), one member shall be designated by the Panel as its Chairman.

4.3 Panel Composition: The Panel will be comprised of recognized safety, management, and engineering experts from industry, academia, and other Government agencies.

4.4 NASA Membership: In accordance with 42 U.S.C. § 2477 (as reauthorized in 2005), not more than four Panel members shall be chosen from the officers and employees of the National Aeronautics and Space Administration.

4.5 Panel Support: The Office of External Relations, NASA Headquarters, will provide staff support to the Panel. The Designated Federal Officer (DFO) will be appointed by the NASA Administrator and will serve as the Executive Director of the Panel.

5.0 PANEL REPORTS

5.1 Findings and Recommendations: The Panel shall deliberate and report its findings and recommendations to the NASA Administrator. Findings that are time critical will be reported immediately.

5.2 Annual Report: The Panel shall submit an annual report to the NASA Administrator and to the Congress. Each annual report shall include an evaluation of the Administration's compliance with the recommendations of the Columbia Accident Investigation Board through retirement of the Space Shuttle.

5.3 Special Reviews and Evaluations: The NASA Administrator may request certain special studies, reviews, and evaluations. The Panel will submit reports with findings and recommendations, as deemed appropriate by the Panel, to the NASA Administrator within the timeline specified by the NASA Administrator.

6.0 ESTIMATED ANNUAL COSTS

NASA Headquarters will provide the budget for operation of the Panel. The estimated annual operating costs total $1,300,000, including two Full Time Equivalents (FTEs) for NASA civil servant staff support, technical report writing, travel, and meeting logistics support.

7.0 ESTIMATED NUMBER AND FREQUENCY OF MEETINGS

7.1 Meetings: There will be four full Panel meetings held each year, on a quarterly basis, to perform the duties as described in Section 2.0.

7.2 Special Meetings: Special meetings of the full Panel may be required and supported as needed.

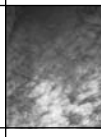
7.3 Additional Meetings: Additional meetings of individual Panelists or small groups of Panelists may be required for fact finding, preparatory or administrative work, and supported as needed.

8.0 DURATION

Since the Panel is a nondiscretionary federal advisory committee required by statute, this charter shall become effective upon the filing of this charter with the appropriate U.S. Senate and House of Representative oversight committees. It shall terminate two years from the date of the filing of this charter unless renewed or terminated earlier by the NASA Administrator.

Signed November 14, 2007

Michael D. Griffin
NASA Administrator



Appendix B: ASAP Panel Members and Staff

Panel Members

Vice Admiral Joseph W. Dyer, USN (Ret.)

- Aerospace Safety Advisory Panel Chair
- President, Military Government & Industrial Division, iRobot Corporation
- Former Commander, Naval Air Systems Command

Vice Admiral Joseph W. Dyer was commissioned through the Aviation Reserve Officer Candidate Program following graduation from North Carolina State University with a bachelor of science degree in chemical engineering. He subsequently earned a master of science degree in financial management from the Naval Post Graduate School, Monterey, CA. He received his wings in March 1971 and was selected as one of the first "Nuggets" (first tour aviators) to fly the Mach 2, RA-5C *Vigilante*. He flew nationally tasked reconnaissance missions in both the eastern and western hemispheres.

From April 1991 to December 1993, Admiral Dyer was the U.S. Navy's chief test pilot. From January 1994 to April 1997, he served as F/A-18 program manager, leading the engineering and manufacturing development (E&MD) effort on the new F/A-18E/F, the continued production and fleet support of the F/A-18C/D and all F/A-18 foreign military sales. The F/A-18 program won the Department of Defense Acquisition Excellence Award and the Order of Daedalian during this period. Admiral Dyer was assigned as the Commander, Naval Air Warfare Center Aircraft Division, Patuxent River, in July 1997 and one month later assumed additional responsibilities as the Naval Air Systems Command, Assistant Commander for Research and Engineering. In June 2000, he was assigned as the Commander, Naval Air Systems Command.

Admiral Dyer is President of the iRobot Corporation's Military Government & Industrial Division. In this position, he works closely with the U.S. Department of Defense to develop reconnaissance robots that will change the way wars are fought in the future.

Dr. James P. Bagian

- Director, National Center for Patient Safety, Veterans Health Administration, U.S. Department of Veterans Affairs
- Medical Consultant and Chief Flight Surgeon, Columbia Accident Investigation Board
- Former Space Shuttle Astronaut

Dr. James P. Bagian is a physician and researcher who has combined his medical expertise with a variety of other disciplines. He has served as: a NASA physician and astronaut; a U.S. Air Force flight surgeon; and an engineer with the U.S. Department of Housing and Urban Development, the U.S. Navy and the Environmental Protection Agency. He now serves as the Director of the National Center for Patient Safety in the Veterans Health Administration, U.S. Department of Veterans Affairs.

During his 15-year tenure with NASA, Dr. Bagian flew on two Space Shuttle missions. He also took part in both the planning and provision of emergency medical and rescue support for the first six Shuttle flights. He led the development of a high-altitude pressure suit for crew escape, along with other crew survival equipment. In addition, he was the first to employ a treatment of space motion sickness that has become the standard of care for astronauts in distress. He served as investigator in the inquiry following the *Challenger* accident in 1986, and in 2003, he was appointed as Medical Consultant and Chief Flight Surgeon for the Columbia Accident Investigation Board (CAIB).

Dr. Bagian's contributions to military service include advancing new methods of military aircraft ejection seat design and serving as a colonel in the U.S. Air Force Reserve. As the Special Consultant for Combat Search and Rescue to the Air Command Surgeon General, he was a leader in standardizing pre-hospital combat rescue medical care across all Air Force major commands.

When the VA National Center for Patient Safety (NCPS) was established in 1999, Dr. Bagian was chosen as the Center's first Director, and he has held that posi-

tion ever since. He developed and implemented the Center's innovative program aimed at protecting patients from hospital-based errors. That program has been put into practice at all 173 VA hospitals, and it is considered to be the benchmark for patient safety in hospitals worldwide. Recognizing this contribution, Harvard University's John F. Kennedy School of Government awarded Dr. Bagian's program its Innovations in American Government Award in 2001. In 2000, Dr. Bagian was elected as a member of the National Academy of Engineering and, in 2003, as a member of the Institute of Medicine.

Dr. Bagian received a bachelor of science degree in mechanical engineering from Drexel University in 1973 and a doctorate in medicine from Thomas Jefferson University in 1977.

Major General Charles F. Bolden, Jr. (Ret.)

- CEO, JACKandPANTHER LLC
- Former Space Shuttle Astronaut
- Former Commanding General, Third Marine Aircraft Wing

Major General Charles F. Bolden, Jr. was a NASA pilot astronaut for 13 years, flying four Space Shuttle missions. Following the Shuttle *Challenger* accident in 1986, he was assigned as the Chief of the Safety Division at the Johnson Space Center, overseeing the efforts to ensure safety as the Shuttle Program returned to flight. He later served as NASA Assistant Deputy Administrator. After leaving the Space Program and returning to service he had begun earlier with the operating forces of the U.S. Marine Corps, General Bolden was assigned as Deputy Commanding General, 1 Marine Expeditionary Force (MEF), Marine Forces, Pacific, in 1997. He served as Commanding General, 1 MEF (Forward) for Operation Desert Thunder in Kuwait from February to June 1998. In July 1998, he was promoted to Major General, serving as the Commanding General of the Third Marine Aircraft Wing.

General Bolden retired from the United States Marine Corps on January 1, 2003, after 34 years of service. He has been awarded a number of military and NASA decorations, and he was inducted into the U.S. Astronaut Hall of Fame in May 2006. He is currently the CEO of JACKandPANTHER LLC, a small business enterprise providing leadership, military and aerospace consulting, as well as motivational speaking.

General Bolden received a bachelor of science degree from the U.S. Naval Academy and a master of science degree in systems management from the University of Southern California. He is a graduate of the U.S. Naval Test Pilot School at Patuxent River, Maryland and has received honorary doctorate degrees from several distinguished universities.

Mr. John C. Frost

- Former Chief, Safety Office, U.S. Army Aviation and Missile Command
- Former Chief, Safety Office, U.S. Army Missile Command

Mr. John C. Frost is an independent safety consultant who retired from Federal service with 33 years of safety engineering experience. Mr. Frost was the Chief of Safety for the U.S. Army Aviation and Missile Command (AMCOM), with world-wide responsibility for missile and aircraft safety. Mr. Frost directed and implemented a comprehensive system safety program for all aspects of a major high-technology organization that developed, fielded and supported state-of-the-art aircraft and missile/rocket systems for the Army worldwide and provided facilities and services for approximately 20,000 residents, workers and visitors at Redstone Arsenal. Before that, he served as the Chief of the Missile Command (MICOM) Safety Office and held other supervisory positions leading various MICOM System Safety, Radiation Protection, Explosive Safety, Test Safety and Installation Safety program elements. Mr. Frost began his Federal career in the Safety Office of the Army's Electronics Command at Fort Monmouth, New Jersey, where he became Chief of System Safety Engineering.

Mr. Frost earned a bachelor of science degree in electrical engineering from the University of Virginia, where he was a DuPont Scholar. He completed a master of science degree, specializing in safety engineering, from Texas A&M University and an additional year of advanced safety engineering training. Mr. Frost is a Senior Member of the International System Safety Society, a Professional Member of the American Society of Safety Engineers, and remains active in various system safety organizations and initiatives.

Ms. Deborah L. Grubbe, P.E.

- Former consultant, Columbia Accident Investigation Board
- Vice President–Group Safety, BP p.l.c.
- Former DuPont Corporate Director–Safety and Health

Ms. Deborah L. Grubbe is Vice President—Process Safety for BP Refining and Marketing. Formerly, Ms. Grubbe was employed by DuPont in Wilmington, Delaware, where she held corporate director positions in safety, operations, and engineering. She is the past Chair of the National Institute of Standards and Technology Visiting Committee, and she served on the oversight committee for the Demilitarization of the U.S. Chemical Weapons Stockpile. Ms. Grubbe is also an Advisory Board Member for the Center for Chemical Process Safety. Ms. Grubbe graduated with a bachelor of science degree with highest distinction in chemical engineering from Purdue University. She received a Winston Churchill Fellowship to attend Cambridge University in England, where she received a certificate of postgraduate study in chemical engineering. She is a registered professional engineer and was named the State of Delaware's 2002 Engineer of the Year.

Mr. John C. Marshall

- President, JMAR Consulting, LLC
- Former Vice President, Corporate Safety and Compliance, Delta Airlines

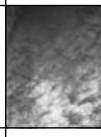
Mr. John C. Marshall is President of JMAR Consulting, a consulting firm whose services and areas of expertise include: aviation/transportation operational issues, aircraft accident investigation, regulatory compliance and safety audits, airline operations, maintenance oversight, technical writing, and technical assistances to legal counsel. Among the firm's clients are: State and Federal agencies, charter operators, international and domestic passenger and cargo carriers, and corporate aviations groups.

Mr. Marshall formerly served as Vice President—Corporate Safety and Compliance for Delta Air Lines. He had responsibility for six departments at Delta, including: Flight Safety, Industrial Safety, Environmental Services, Emergency Planning and Operations, Safety Analysis and Quality Assurance, and Security. Central to the mission of each of these organizations are FAA, DOT, DOD, OSHA, EPA, TSA and DHS compliance-driven programs for accident prevention, accident investigation, accident response and a wide range of security programs. Mr. Marshall also had collateral responsibilities for integrating safety, compliance and security programs for Delta's wholly-owned subsidiaries, including Comair, Atlantic Southeast Airlines, Delta Global Services, and Delta Technologies, into Delta's mainstream programs. Under his leadership, Delta was routinely recognized for industry-leading programs focused on reducing aircraft mishaps, employee injuries and aircraft ground damage, while enhancing environmental compliance programs and fostering the highest standards of security for worldwide commercial airline operations.

Mr. Marshall served as the industry Co-Chair of the Commercial Aviation Safety Team (CAST). CAST is a joint industry-government program to develop and implement an integrated, data-driven strategy to reduce the U.S. commercial aviation fatal accident rate by 80 percent by 2007. Participants include: aircraft and engine manufacturers, passenger and cargo airlines, labor unions, the Flight Safety Foundation, the Air Transport Association, the Regional Airline Association, NASA, DoD, and the FAA. Mr. Marshall is also the past Chairman of the Air Transport Association of America's Safety Council and the Society of Automotive Engineers' Aerospace Symposium. He currently serves on boards for the National Defense Transportation Association's Military Subcommittee, Safe America (a nationwide nonprofit organization focusing on safety awareness), the Flight Safety Foundation and the Nature Conservancy's International Leadership Council.

Mr. Marshall gained worldwide aviation experience through his 26-year career with the U.S. Air Force. His Air Force assignments included duties as a fighter pilot, special assistant to the Air Force Vice Chief of Staff, fighter squadron commander, base commander and fighter wing commander. During his career, he primarily flew F-4s, F-15s, A-10s, and F-16s, but has experience in a variety of other aircraft as well. Mr. Marshall later served as the Inspector General of the Pacific Air Forces and then became the Director of Operations of the Pacific Air Forces. While in the Pacific, he oversaw the safe and efficient operations of more than 400 combat aircraft, including development of plans and policies used for executing his command's annual flying program. In his last assignment, he served as the U.S. Director of Security Assistance for the Middle East, where he was responsible for all sales, marketing, training and logistic support between the United States and 11 countries in the Middle East, Africa, and Southwest Asia during and immediately after the Gulf War.

Mr. Marshall received his bachelor's degree in civil engineering from the Air Force Academy in Colorado, and he is also a graduate of the National War College. He holds a master of arts degree in personnel management from Central Michigan University and a master of science degree in civil engineering (environmental) from the University of Hawaii.



Ms. Joyce A. McDevitt, P.E.

- Systems Safety Consultant
- Former Safety Program Manager, Futron Corporation and Computer Sciences Corporation
- Former NASA System Safety Engineer (retired)

Ms. Joyce McDevitt is a systems safety consultant who recently worked with the Johns Hopkins University's Applied Physics Laboratory (APL) to develop and launch the Pluto-New Horizons Mission Spacecraft. Prior to entering consulting full-time, she was a program manager with Futron Corporation, Bethesda, MD; and Computer Sciences Corporation, Springfield, VA, where she provided range safety and system safety support to government and commercial clients, including project safety responsibilities for APL's Midcourse Space Experiment Spacecraft. She also supported the Commercial Space Transportation Licensing and Safety Division of the Federal Aviation Administration. In addition, she served as a National Research Council committee member for studies of space launch safety and safety of tourist submersibles.

During her nearly 30 years of Civil Service to NASA Headquarters, the Air Force Systems Command and the Naval Ordnance Station, Ms. McDevitt's safety experience included space, aeronautical, facility and weapons systems, as well as propellant, explosive, and chemical processes. She has developed and managed: safety programs, hazard analyses, safety risk assessments, safety policies and procedures, investigations of mishaps, and safety training. She retired from the Federal Government in 1987.

Ms. McDevitt received a B.S. in chemical engineering from the University of New Hampshire and an M.S. in engineering from Catholic University. She is a registered Professional Engineer in Safety Engineering and a Senior Member of the International System Safety Society.

Dr. Donald P. McErlean

- Director, Federal Programs, L-3 Communications, Integrated Systems Group
- Former Chief Engineer, Naval Aviation

Dr. Donald P. McErlean served on military active duty as an aerospace engineering officer, U.S. Air Force Systems Command, from 1970 to 1973. He joined the Air Force Aeropropulsion Laboratory in 1973 as an aerospace engineer. In 1979, he joined the Aeronautical Systems Division as a systems engineering manager and was subsequently promoted to Systems Program Office Director. He then led a wide variety of Air Force propulsion programs and applications.

Appointed a member of the federal Senior Executive Service (SES) in 1987, Dr. McErlean joined the Naval Air Development Center, as Director of Air Vehicle and Crew Systems Technology. In 1994, Dr. McErlean was jointly selected by both the Navy and Air Force as Technical Director for the Joint Strike Fighter Program. In 1997 he joined the engineering management of Naval Air Systems Command, where he was head of the Air Vehicle Engineering Department, as well as Executive Director for Command-Wide Test and Evaluation and Executive Director, Naval Air Warfare Center Aircraft Division. He then served as the Deputy Assistant Commander for Logistics and Fleet Support, overseeing Naval Aviation's build-up for operations in Iraq and Afghanistan. In 2003, he was appointed Deputy Assistant Commander for Research and Engineering and Naval Aviation's Chief Engineer.

Dr. McErlean left Federal service in 2005, after a career of more than 35 years, when he became President and CEO of the Center for Strategic Analysis. CSA provided high-level expertise to both industry and government in areas of national interest, emerging technology, and public policy. In 2007, Dr. McErlean accepted a position with L-3 Communications, where he serves as the Director for Federal Programs. In this position, Dr. McErlean has responsibilities for modification and heavy structural maintenance of the Navy's P-3 and EP-3 aircraft, as well as aircraft from the U.S. Army and the Department of Homeland Security.

Dr. McErlean is the recipient of several SES awards for exceptional performance. In 1987 he received the Exceptional Civilian Performance Medal from the Air Force. He received the Presidential Rank Award from President Clinton in 1993 and 1999

and from President Bush in 2005. He is the recipient of the Navy Superior Civilian Performance Medal and the Navy Distinguished Civilian Performance Medal (the Navy's highest civilian award for performance).

Dr. McErlean was named to the U.S. delegation to the Flight Vehicle Integration Panel of NATO's Advisory Group for Aerospace Research and Development (AGARD), eventually being elected Vice Chairman of that panel. He also served as the Navy member of the U.S. delegation to the Aerospace Group of the Technology Cooperation Program (TTCP).

Dr. McErlean has served on numerous technical advisory panels for NASA, DOD and the Office of Science and Technology Policy (OSTP) and was Chair of the Tri-Service Science and Technology Reliance Panel on fixed-wing aircraft research. He was a member of the Science and Technology Advisory Panel for the Johns Hopkins Applied Physics Laboratory. He was appointed by the Governor of Maryland to both the Commission for the Development of High Technology Business and to the Board of the Southern Maryland Higher Education Center.

Dr. McErlean was born in Orange, New Jersey. He received his Ph.D. in aerospace engineering (fluid dynamics major and applied mathematics minor) from Rutgers University and a master's degree in business/management from the Sloan School of Management at M.I.T. He is married to the former Sally Kathryn Shindell of North Arlington, New Jersey. They have one son, Timothy, who makes his home in Austin, Texas.

Mr. Brock R. "Randy" Stone

- President, Cimarron Software Service, Inc.
- Former Deputy Center Director, Johnson Space Center
- Former Director of Mission Operations, Johnson Space Center

Mr. Randy Stone is the President of Cimarron Software Services, Inc. in Houston, Texas. He retired from NASA in March 2004 after 37 years in human space flight operations. At the time of his retirement, Mr. Stone held the position of Deputy Center Director of the Johnson Space Center. Prior to that, he held the position of Director of Mission Operations from1997 to 2001, responsible for the oversight of all human space flight operations, including astronaut training, flight planning, mission control center development and operations, and vehicle simulator development and operations. From 1992 through 1996, he was the Assistant Director for Operations, responsible for the planning and execution of all Space Shuttle missions. Prior assignments included Chief of the Flight Director Office and Flight Director for numerous Shuttle missions. Mr. Stone's NASA experience spans Apollo, Apollo-Soyuz, Skylab, Space Shuttle, and the International Space Station. He is a 1967 graduate of the University of Texas at Austin, with a bachelor's degree in aerospace engineering.

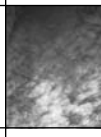
Mr. Stone is married to the former Susan Golden from Pasadena, Texas, and they have two grown daughters, Kari Wilson and Allison Campbell.

ASAP Staff Members

- Kathy Dakon, Executive Director
- Susan M. Burch, Staff Assistant
- Lester A. Reingold, Annual Report Editor

Appendix C: ASAP Activities–January-December 2007

DATES WORKED	PURPOSE	LOCATION
January 10-12, 2007	2007 1st Quarterly Meeting	HQ
March 29, 2007	Insight Meeting	GRC
April 23-24, 2007	2007 2nd Quarterly Meeting	JSC/Cancelled
May 17, 2007	Insight Meeting	HQ
July 11-13, 2007	2007 3rd Quarterly Meeting	JSC
October 10-12, 2007	2007 4th Quarterly Meeting	GRC
November 8, 2007	Insight Meeting	DFRC
December 4, 2007	ASAP Annual Report Prep Meeting	HQ



Appendix D: Letter from Christopher J. Scolese, NASA Associate Administrator, to the ASAP

National Aeronautics and
Space Administration
Office of the Administrator
Washington, DC 20546-0001

January 17, 2008

Mr. Joseph W. Dyer, VADM, USN (Ret.)
Chairman
Aerospace Safety Advisory Panel
National Aeronautics and Space Administration
Washington, DC 20546

Dear Admiral Dyer:

On August 26, 2003, the Columbia Accident Investigation Board (CAIB) released Volume I of its final report. Since then, NASA has incorporated the recommendations and observations of the CAIB into the Space Shuttle Program's (SSP) ongoing drive to improve the safety of this complex system.

Enclosed is a summary of the actions taken through October 2007, to address the CAIB's recommendations and observations. In addition, NASA has a number of activities planned or in work for 2008 that continue to address specific issues noted in the CAIB final report.

- CAIB Recommendation 3.2-1, External Tank (ET) Thermal Protection System (TPS) Modifications. In 2008, NASA will fly the first ET's to incorporate redesigned ice-frost ramps and liquid oxygen feedline brackets designed to minimize the risk of foam debris liberation. These tanks will fly on Space Transportation System (STS)-124 and STS-125. The Design Certification Review for the STS-124 tank, ET-128, will be held in January.

- CAIB Recommendation 3.3-2, Orbiter Hardening. In addition to the orbiter hardening actions noted in the presentation (main-landing gear door corner void elimination, reaction control system carrier panel redesign, side cockpit window replacements, etc.,) NASA is accelerating the installation of hardened BRI-18 tiles around the landing gear and ET umbilical doors on all three orbiters.

- CAIB Recommendation 6.4-1, TPS Inspection and Repair. NASA will continue to pursue thermal protection inspection and repair techniques throughout 2008. Recent work by the SSP and Dr. William Winfree of the NASA Engineering Safety Center (NESC) has helped to refine our in situ, nondestructive techniques and methodologies for assessing the integrity of Reinforced Carbon-Carbon (RCC). Based in part on the results of thermographic analytical techniques know as "Winfree values," select wing-leading edge RCC panels are being removed for further computer tomography scans and to refine the criteria for RCC screening. We are also working with NESC

to install a flash unit in the left-hand ET umbilical well forward camera location, which will provide supplemental lighting, in day and night settings, to the digital umbilical and 16 millimeter motion picture cameras during tank separation. On-orbit testing of these TPS repair techniques will continue in 2008, with the demonstration of the Tile Repair Ablator Dispenser/STA-54 tile repair technique on STS-123.

We will continue to keep the Aerospace Safety Advisory Panel informed on these other ongoing activities, including NASA's rationale for discontinuing the large area tile repair technique.

Sincerely,

CJSc

Christopher J. Scolese
Associate Administrator

Enclosure

Image credit (front cover, center): Lockheed Martin Corp.