AUDIT REPORT **IG-05-024**

RISKS ASSOCIATED WITH NASA'S PLAN FOR TECHNICAL AUTHORITY AND SAFETY AND MISSION ASSURANCE

August 19, 2005

National Aeronautics and Space Administration

OFFICE OF INSPECTOR GENERAL

Released by: Evelyn R Klemstine

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Assistant Inspector General for Auditing

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August 19, 2005

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Executive Summary

We conducted an audit to review NASA's plans for implementing the recommendations the Columbia Accident Investigation Board (CAIB) made related to organizational causes of the accident. The overall audit objective was to assess NASA's plans to address the organizational causes of the accident and ensure potential weaknesses are appropriately addressed. Specific audit objectives were to evaluate NASA's plans to (1) implement an independent Technical Engineering Authority (Recommendation 7.5-1); (2) establish direct-line authority for Space Shuttle safety within the Headquarters Office of Safety and Mission Assurance (SMA) (Recommendation 7.5-2); and (3) reorganize the Space Shuttle Integration Office (Recommendation 7.5-3).

Background. Following the February 1, 2003, loss of the Space Shuttle Columbia, the NASA Administrator appointed the CAIB to investigate the cause of the accident. In its August 2003 final report, the CAIB concluded that NASA's culture and organization had as much to do with the accident as the physical causes. The CAIB found that NASA's system safety engineering and management were separate from mainstream engineering, hidden in other safety disciplines at NASA Headquarters, and not vigorous enough to have an impact. In addition, SMA's ability to oversee operations and communicate potential problems was limited because oversight and communications were primarily dependent upon the Space Shuttle Program for funding. In addition, the Space Shuttle Integration Office was not truly integrating all elements of the entire Space Shuttle Program.

Prior to returning the Space Shuttle to flight, CAIB Recommendation 9.1-1 required that NASA prepare a detailed plan for defining, establishing, transitioning, and implementing Recommendations 7.5-1, 7.5-2, and 7.5-3. Recommendation 9.1-1 was a "Return to Flight" constraint and was extensively reviewed by the Return to Flight Task Group, which determined that NASA's actions were responsive to the recommendation and closed its review on June 8, 2005.

Results. In November 2004, NASA issued draft policy and procedures for an engineering authority responsible for establishing, monitoring, and approving technical requirements across the Agency. Additionally, on March 7, 2005, the Agency issued an update to "NASA Plan for Implementing Safe and Reliable Operations" that addresses fundamental changes being made in response to Recommendation 9.1-1 to improve the safety and reliability of Space Shuttle operations. We believe the organizational structure planned for the technical authority poses some risks. Specifically, while NASA's Plan

makes it clear that Technical Warrant Holders (TWHs) are ultimately accountable for technical requirements, NASA's Plan does not include processes and procedures to monitor the warrant system and ensure that the individual integrity, competence, and independence of TWHs are maintained. Additionally, further discussion is needed over which standards and/or requirements TWHs will own, the definition of ownership, and how engineering and SMA standards will be integrated to ensure that both technical and safety concerns are appropriately addressed.

We understand that the Independent Program Assessment Office is planning to review the implementation of the Technical Authority. We believe a review, which addresses the concerns we have described in this report, should help the Chief Engineer identify the processes needed to maintain the strength, effectiveness, and long-term sustainability of the Technical Authority. In addition, as of August 2005, the Technical Authority concept was being modified. Therefore, we are not making any recommendations. However, we will continue to monitor NASA's revision and subsequent implementation of the Technical Authority, focusing on the concerns described in this report. (Finding A)

NASA's Plan describes changes to strengthen the independent funding and reporting paths for SMA functions across the Agency. However, NASA diverged from the explicit intent of the CAIB recommendation by not implementing direct-line funding or reporting for Shuttle Program SMA personnel. NASA must now demonstrate that its Plan is thorough enough to capture and implement the intent of the CAIB recommendation as well as ensure that the SMA function is sufficiently independent. We will continue to monitor NASA's modifications of the SMA function, focusing on the concerns described in this report. (Finding B)

NASA has taken steps that address CAIB concerns related to the Space Shuttle Integration Office, including the transformation of that office into the Systems Engineering and Integration Office, which is solely responsible for the systems engineering and integration of flight performance of all Space Shuttle elements. Key improvements included placing the office at a higher organizational level within the Space Shuttle Program Office structure and increasing the office manager's grade level to a level commensurate with the increased responsibility.

Recommendation for Corrective Action. Because NASA has chosen to diverge from the CAIB recommendation, we recommend that the Chief SMA Officer demonstrate that there is a healthy, sustainable, independent oversight function at the Centers.

Management Comments. Management concurred and stated that actions already taken or planned will provide strong oversight for Center SMA functions. The Chief SMA Officer stated that he closely monitors the effectiveness of SMA functions and that NASA policy dictates that all employees and their managers share the responsibility for safety. In addition, SMA plans to review safety reporting processes and is considering increasing the time spent at NASA Centers by the Headquarters SMA personnel. See Appendix B for the complete text of management's response.

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Acronyms Used in the Report

CAIB	Columbia Accident Investigation Board
G&A	General and Administrative
GAO	Government Accountability Office
IPAO	Independent Program Assessment Office
MDAA	Mission Directorate Associate Administrator
NESC	NASA Engineering and Safety Center
NPD	NASA Policy Directive
NPR	NASA Procedural Requirements
SEIO	Systems Engineering and Integration Office
SIAT	Shuttle Independent Assessment Team
SMA	Safety and Mission Assurance
TWH	Technical Warrant Holder

RISKS ASSOCIATED WITH NASA'S PLAN FOR TECHNICAL AUTHORITY AND SAFETY AND MISSION ASSURANCE

Objectives

The overall audit objective was to assess the adequacy of NASA's plans to address the organizational causes of the Columbia accident and to ensure potential weaknesses are appropriately addressed as part of the Agency's efforts to return the Space Shuttle to flight. Specific objectives were to evaluate NASA's plans to (1) implement an independent Technical Engineering Authority (Recommendation 7.5-1); (2) establish direct-line authority for Space Shuttle safety within the Headquarters Office of Safety and Mission Assurance (SMA) (Recommendation 7.5-2); and (3) reorganize the Space Shuttle Integration Office (Recommendation 7.5-3.)

Background

After a 7-month independent investigation into the February 1, 2003, Space Shuttle Columbia accident, the Columbia Accident Investigation Board (CAIB) found that the management practices overseeing the Space Shuttle Program were as much a cause of the accident as the foam striking the left wing leading edge. Part Two of the CAIB report, "Why the Accident Occurred," examined NASA's organizational, historical, and cultural factors and how those factors contributed to the accident. The Board concluded that NASA's organization did not provide effective checks and balances, did not have an independent safety program, and had not demonstrated the characteristics of a learning organization. After comparing the Columbia and Challenger accidents, the CAIB was not confident that without substantial management changes, corrective actions to the recommendations alone would improve safety for the Space Shuttle Program.

The CAIB expected to find SMA deeply engaged in the decision processes of Space Shuttle Program management. Instead, the CAIB found a lack of SMA involvement, which had prevented safety personnel from providing needed checks and balances. The Space Shuttle Program had also fallen into a pattern of accepting problems, such as the external tank shedding foam debris, without sufficient engineering analysis.

To reinvigorate the engineering discipline, the CAIB recommended that NASA establish a Technical Authority responsible for technical requirements and for building a disciplined systematic approach to identify, analyze, and control hazards. The CAIB also recommended that NASA's Headquarters Office of SMA have direct-line authority over the entire Space Shuttle safety program. According to the CAIB, both the independent Technical Authority and the SMA should be independently resourced. The CAIB additionally recommended that the Space Shuttle Program reorganize and strengthen the Space Shuttle Integration Office so that the integration function would encompass all elements of the Space Shuttle Program.

Space Shuttle Engineering and Integration Office

As a result of key improvements, the Space Shuttle Program Manager now has an office with continuous and consistent responsibility to integrate all anomalies, corrective actions, and risks associated with the Space Shuttle. On December 3, 2003, the Space Shuttle Program Manager issued the charter for the Space Shuttle Systems Engineering and Integration Office (SEIO) to explicitly communicate the roles and responsibilities of that office across the Space Shuttle Program. The SEIO is responsible for the performance and safety of the Space Shuttle vehicle ground and flight activities when multiple project elements are involved.

Key improvements of the SEIO charter involved placing the SEIO at a higher organizational level within the Space Shuttle Program Office structure, increasing the office manager's grade level to a level commensurate with the increased responsibility, and increasing the number of program and contractor employees supporting the office. For example, the SEIO Manager leads a Systems Integration Control Board and each program element is a mandatory member of that Board. Additionally, the Propulsion Systems Engineering and Integration Office at Marshall Space Flight Center and the Systems Integration Office at Kennedy Space Center receive technical direction and coordination from and report directly to the SEIO for all integration-related activities.

Findings

A. Technical Authority and Warrant System

In response to CAIB Recommendation 7.5-2, NASA issued "NASA Plan for Implementing Safe and Reliable Operations" (the Plan) as well as draft policy and procedures for an engineering authority responsible for establishing, monitoring, and approving technical requirements across the Agency. At the same time, the NASA Administrator designated the Chief Engineer as NASA's Technical Authority and permitted the Chief Engineer to delegate that authority to selected individuals through a system of warrants. Those who were granted such authority were designated as Technical Warrant Holders (TWHs). The TWHs were envisioned as the Agency's "technical conscience." The Plan, which was revised on March 7, 2005, outlines the steps necessary for restoring the engineering discipline and visibility throughout the Agency. To make the warrant system effective and ensure that the integrity and independence of the TWH are maintained, procedures and processes will need to be established and monitored.

CAIB Recommendation

In its August 2003 final report on the Space Shuttle Columbia accident, the CAIB identified that NASA did not have clear, clean lines of technical authority, responsibility, and accountability. According to CAIB Recommendation 7.5-1, NASA should:

> Establish an independent Technical Engineering Authority that is responsible for technical requirements and all waivers to them, and will build a disciplined, systematic approach to identifying, analyzing and controlling hazards throughout the life cycle of the Shuttle System . . . The Technical Engineering Authority should be funded directly from NASA Headquarters, and should have no connection to or responsibility for schedule or program cost.

NASA's Response to the CAIB

To address Recommendation 7.5-1, NASA issued draft NASA Policy Directive (NPD) 1240.4, "NASA Technical Authority," dated November 23, 2004. That draft NPD[1] gives the Chief Engineer responsibility and accountability to establish, approve, and maintain technical requirements, processes, and policy to conduct and oversee high-risk technical work. The Chief Engineer delegates that authority to competent, experienced individuals (known as TWHs) through a system of warrants.

Also issued on November 23, 2004, Draft NASA Procedural Requirements (NPR) 1240.1, "NASA Technical Warrant System,"[2] discusses and identifies the types of TWHs: Systems and Discipline. Systems warrant holders provide checks and balances for mission-related programs and projects by maintaining technical standards, processes,

[1] NASA is revising the NPD because of the Administrator's June 23, 2005, request for modifications.
[2] NASA is revising the NPR because of the Administrator's June 23, 2005, request for modifications.

policies, and variances for assigned systems, such as the Space Shuttle, the International Space Station, or aviation systems. In January 2005, the Chief Engineer advised the Aerospace Safety Advisory Panel that the role of systems TWHs was a full-time position. In contrast and in a broader sense, discipline warrant holders maintain technical standards for specific disciplines such as structures, power, or software engineering. The discipline warrant may or may not require a full-time TWH.

Risks in Reporting Structure

According to the draft NPR, the TWHs report directly to the Chief Engineer for daily tasks, although their organizational reporting structure and performance evaluation still aligns them to a Center Director. For example, TWHs for both the Space Shuttle Systems warrant and the International Space Station Systems warrant permanently reside in the Engineering Directorate at the Johnson Space Center (Johnson). The Engineering Directorate ultimately reports to Johnson's Center Director. Although Draft NPR 1240.1 states that Center Directors will ensure that TWHs do not have a supervisory reporting chain to the managers of various programs or projects, an unintended connection to the program officials responsible for schedule or program cost could occur over time. NASA has also recognized the potential for conflict between programmatic pressures and Technical Authority decisions and addressed that concern in the actual warrant, which states:

> This warrant does not circumvent your responsibilities to your operational chain of authority. However, it does provide you with the authority and accountability to directly access the Chief Engineer without fear of administrative repercussions in issues affecting safe and reliable operations.

On April 18, 2005, the NASA Administrator realigned the reporting structure to require that Center Directors report directly to the Administrator's office rather than to a Mission Directorate Associate Administrator (MDAA). In a June 23, 2005, memorandum, the NASA Administrator directed a refinement of the policy and approach for the conduct of Technical Authority at NASA, stating that independent Technical Authority implementation "will be re-delegated to the Centers by the Chief Engineer [and that] Center Directors will select systems warrant holders and discipline leads who will have decision authority on program/project technical matters with the exception of variances to NASA standards." The memorandum further stated that variances will be the responsibility of discipline warrant holders, who will still report to the Chief Engineer via the Deputy Chief Engineer. We believe these changes will help alleviate our concerns that programmatic pressure can potentially influence TWHs.

Process to Ensure Sustainability

One of the Plan's five key principles for the Technical Authority is that authority for technical requirements must reside in an individual and not an organization. Consequently, NASA is relying solely on the integrity of the TWH to champion technical decisions that could adversely affect a major program. While that concept makes clear that the TWH is accountable, neither the Plan nor the draft NPR 1240.1 addresses

processes and procedures for monitoring and ensuring that the integrity, competence, and independence of the individual TWHs are maintained. For example, the Chief Engineer has not established processes or procedures to:

1. periodically assess the performance of the TWH to ensure integrity and independence are maintained.

2. ensure consistency and adequacy in the review and application of technical standards across the Agency.

3. ensure the pressures of being asked to individually challenge a major program do not discourage subject matter experts from accepting the TWH role.

4. address succession planning because the warrant system is based on an individual rather than an organizational concept.

We understand that the Independent Program Assessment Office (IPAO)[3] is planning to review the implementation of the Technical Authority. That review should include the concerns we have listed above. We believe such a review should help the Chief Engineer identify the processes needed to ensure the strength, effectiveness, and long-term sustainability of the Technical Authority.

Roles and Responsibilities for TWHs and SMA

The Plan also lacks details concerning the roles and responsibilities of the TWHs and SMA personnel. Further discussion is needed on which standards and/or requirements TWHs will own, the definition of ownership, and how engineering and SMA standards will be integrated to ensure that both technical and safety concerns are appropriately addressed. Roles and responsibilities for Technical Authority and SMA must be clearly stated and agreed upon across the Agency.

Conclusion

We believe the organizational structure planned for the technical authority poses some risks. On the one hand, TWHs—empowered to be NASA's technical conscience—must be devoid of program pressures such as cost, schedule, and mission accomplishment. However, to say that TWHs will be fully immune to program pressures is not realistic. Procedures and processes will need to be established and monitored to make the warrant system effective and ensure that the integrity as well as the independence of each TWH is maintained. Because the implementation of NASA's Plan continues to be under development, we are not making any recommendations. We will continue to monitor NASA's implementation of the technical authority, focusing on the concerns identified in this report.

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[3]NASA established the Program Analysis and Evaluation Office at Headquarters in May 2005. The IPAO was realigned under that office, thus removing it from the Office of the Chief Engineer.

B. Safety and Mission Assurance Office

While the Agency has taken numerous actions since the Columbia accident, the Chief SMA Officer has diverged from the explicit intent of the CAIB recommendation and stated that he does not believe direct-line funding or reporting for all SMA personnel is necessary. As a result, the implementation steps outlined in "NASA Plan for Implementing Safe and Reliable Operations" (the Plan) do not provide a completely independent funding and reporting path solely accountable to the Chief SMA Officer at Headquarters.

Previous Concerns over SMA Independence

The CAIB stated in Recommendation 7.5-2 that the NASA Headquarters Office of SMA should have direct-line authority over the entire Space Shuttle Program safety organization and it should be independently resourced. Even before the CAIB, numerous commissions or studies had comments or recommendations concerning the funding and reporting independence of the SMA.

In June 1986, the President's Commission on the Space Shuttle Challenger Accident (the Rogers Commission) recommended that NASA establish an Office of SMA at NASA Headquarters and that it should be headed by an Associate Administrator who would report directly to the NASA Administrator with direct authority for SMA functions throughout the Agency. While NASA did establish an Associate Administrator for SMA, neither direct-line reporting nor independent funding for Center SMA functions was ever established.

In 1990, the General Accounting Office, now the Government Accountability Office (GAO), recommended that NASA independently fund safety activities through the Headquarters Office of SMA. NASA chose not to implement the GAO recommendation because such implementation would (1) lessen the program's SMA responsibilities, (2) do away with Center SMA organizations having to defend and support their requirements to the program, and (3) require an increase in Headquarters SMA administrative staff.

In 2000, the Shuttle Independent Assessment Team (SIAT) recommended that the NASA SMA be restored to its previous role of independent oversight rather than simply being a "safety auditor." The SIAT stated that NASA SMA was moving away from an oversight role to one of insight, in which direct involvement was being replaced by periodic surveillance and audits. In addition, the SIAT was concerned that the movement would result in (1) fewer independent reporting paths as the NASA presence was withdrawn from engineering and operations teams, and (2) a reduced ability of the SMA function to determine and enforce compliance with safety and reporting requirements.

During congressional testimony on May 14, 2003, the CAIB chairman, referring to the SMA Office before the Columbia accident, stated, "We find the safety organization is on paper, perfect. But when you bore down a little bit deeper, you don't find anything

there." He went on to clarify his remarks by saying that key SMA advisors, those who can bring up alternative points of view, were not adequately or independently funded. While the 2003 findings and recommendations of the CAIB are not an exact duplication of previous commissioned studies, a continuous theme has been woven throughout the years when discussing a lack of SMA independence for funding and reporting.

Changes in the SMA Funding Process

In response to the CAIB report, NASA established at each Center in October 2004 directed service pools that would allocate SMA resources to programs and projects. The directed service pools are not funded with general and administrative (G&A) funds; rather, they are funded by NASA programs. We are concerned that funding for the directed service pools could become more constrained as the Space Shuttle Program enters its retirement phase and the overall program budget decreases. Retirement concerns, such as loss of experienced personnel and program vendors as well as lowered morale, could intensify the need for adequately funded SMA activities at the Centers. History and lessons learned have demonstrated that a string of successful missions or the auspices of funding constraints can lead to a reduction in SMA activity.

While the directed service pool is an improvement over the previous SMA funding mechanisms, SMA officials must still negotiate their budgets with Center Directors and the program/project management they are responsible for assessing. It is unknown how the recent realignment of the Center Directors reporting directly to the Administrator's office rather than to an MDAA will affect the SMA funding process. Should any changes to the SMA funding process be made, it is imperative that SMA funding remain independent from NASA programs.

Changes in SMA Direct-Line Reporting

According to the Plan, NASA's Chief SMA Officer will have more influence and formal input into the appraisal of the Center and program SMA senior managers. Although authority over those SMA managers has increased, the Chief SMA Officer does not plan to establish a Center SMA presence solely accountable to the Headquarters Office of SMA. Specifically, all SMA personnel residing at the Centers continue to report to Center Directors. Furthermore, Center Directors and program managers continue to have "supervisory status" over Center SMA Directors and Program SMA Managers respectively. In that regard, the Agency elected to diverge from the CAIB-recommended position that the Chief SMA Officer have direct-line authority over Shuttle Program safety.

Even after all the post-CAIB changes detailed in the Plan, SMA personnel are still required to bypass their formal chain of command to report significant concerns directly to the Chief SMA Officer. If program or Center personnel are forced to go outside of their formal chain of command, particularly during key, real-time decision processes, they could be placed in a compromised position of disagreeing with officials who evaluate their job performance. As stated in section 8.6 of the CAIB report: "People who

are marginal and powerless in organizations may have useful information or opinions that they don't express. Even when these people are encouraged to speak, they find it intimidating to contradict a leader's strategy or a group consensus." Therefore, we feel it is critical to establish a system whereby safety issues are fully addressed and, if necessary, forced out into the open.

Third Set of Eyes

If NASA is going to diverge from the strict intent of the CAIB, the Chief SMA Officer should demonstrate that there is a healthy, sustainable, independent oversight function at the Centers that will maintain a concept informally known as the "third set of eyes."

Contractor SMA personnel overseeing the efforts of the work force provide the first set of eyes. Center and program SMA personnel provide the second set of eyes, overseeing the contractor and performing their own independent analysis when needed or desired. The third set of eyes is generally provided by experienced safety professionals or engineers who are able to independently observe key decision-making processes. They have the power and authority to go where they want to, when they want to. Those individuals would be expected to follow their intellectual and safety curiosity, look for undetected or overlooked issues, listen for dissenting opinions, push for "root cause" thinking, and ask probing questions—all in an effort to provide assurance that decision makers have adequately considered all relevant facts. Those personnel should have no funding or administrative ties to the Center where they reside or to the Programs based at that Center.

Although the concept of a third set of eyes is not unique to safety, its importance is paramount because the results of any undetected mistake brought about by human error can be catastrophic. Human errors can allow problems to go undetected, unreported, or reported without sufficient accuracy and emphasis. The third set of eyes should be considered an integral part of high-risk programs such as the Space Shuttle because an active third set of eyes decreases the risk of overlooking human error and, ultimately, undesirable consequences. Both the Rogers Commission and CAIB reported that SMA personnel were either absent or silent during key decisions prior to both Space Shuttle accidents. Additionally, the SIAT proposed the following in its report of 2000:

> Recent reductions in duties and personnel have resulted in a Safety and Mission Assurance process that appears largely absent from day-to-day activities of Shuttle operations and maintenance. Further, the deficiencies observed in risk assessment, risk communication and problem trending, and the increasing occurrences of "stumble-ons," "diving catches" and "escapes" indicates degradation in the Safety & Mission Assurance system that remains. The SIAT strongly believes in the necessity of an experienced, well-staffed NASA quality assurance function ("second set of eyes") and an independent, empowered NASA Safety & Mission Assurance function ("third set of eyes.")

The Plan states that Headquarters SMA functional oversight of the Centers will be improved through enhanced policy and audits. However, internal and external reviews have shown that relying on audits and surveillance to verify SMA will probably not be sufficient. No substitute exists for a real-time, completely independent presence not only

during critical program decisions but also during the day-to-day activities. The CAIB noted in Chapter 8, "In both pre-accident periods, events unfolded over a long time and in small increments rather than in sudden and dramatic occurrences." We do not believe that periodic audits or visits by Headquarters-based SMA personnel will be thorough enough to capture and implement the intent of the CAIB for a real-time, long-term, independent presence.

The Chief SMA Officer at Headquarters defers accountability for day-to-day SMA activities to Center Directors in accordance with NASA's philosophy for managing mission support functions. The Chief SMA Officer stated that MDAAs and Center Directors are ultimately accountable for mission success, while the role of the Chief SMA Officer is to be accountable for providing leadership, policy direction, functional oversight, assessment, and Agency wide coordination of SMA activities. According to the Chief SMA Officer, removing SMA from the institutional chain of command could cause the perception of relieving program managers and Center Directors of their accountability for ensuring safe and reliable operations.

Although there are numerous organizational alternatives for SMA, we question whether assigning sole responsibility for SMA activities to Center Directors and MDAAs is enough to satisfy the full intent of the CAIB. Center and program management's accountability for safety will not be compromised by a third set of eyes. Conversely, we believe that the completely independent third set of eyes will more closely approximate the intent of the CAIB recommendation.

Conclusion

NASA management has made a conscious decision not to implement fully the latest in a long series of recommendations concerning independent funding and reporting for SMA. In lieu of full implementation, NASA has instituted many changes in its organization to include establishing the Technical Authority, the NASA Engineering and Safety Center (NESC),[4] and the Ombuds[5] concept.

Although various elements of the post-CAIB changes may encompass the concept and features of an independent third set of eyes, NASA needs to assess whether the function is better left divided among and between these various elements or centralized into one entity. However, NASA must now demonstrate that its Plan is thorough enough to

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[4] The NESC, based at the Langley Research Center, was created shortly after the Columbia accident and became operational on November 1, 2003. The NESC is an Agency-wide technical resource focused on engineering excellence. The objective of the NESC is to improve safety by performing in-depth independent engineering assessments, testing, and analysis to uncover technical vulnerabilities and to determine appropriate preventative and corrective actions for problems, trends, or issues within NASA's programs, projects, and institutions.

[5] The Ombuds program was established to provide the civil service and contractor workforce a confidential, supplemental, and informal channel to communicate critical issues and concerns that could impact safety, organizational performance, or mission success. The program serves as a channel that addresses issues that are not the exclusive responsibility of existing administrative systems or offices. The Ombuds reports directly to the Center Director.

capture and implement the concept of the third set of eyes as well as eliminate any further repetitive findings that the SMA function is not sufficiently independent.

Recommendation for Corrective Action

In lieu of implementing the CAIB recommendation, the Chief SMA Officer should demonstrate that there is a healthy, sustainable, independent oversight function at the Centers.

Management's Response

Management concurred with our recommendation and has determined that actions already taken or underway by SMA will provide strong oversight for Center SMA functions. The Chief SMA Officer stated that he closely monitors the effective pursuit of all SMA functions across the Agency and ensures that oversight of program and institutional operations is independent and thorough. In addition, NASA policy dictates that everyone in NASA is responsible for the safety of their individual actions, and that leadership is to be held accountable for the safety of operations entrusted to their control to the extent of their authority and capability. Lastly, SMA plans to expand the scope of its audits to include a review of the safety reporting process and SMA is considering increasing the time spent at NASA Centers by Headquarters SMA personnel. See Appendix B for the complete text of management's response.

Evaluation of Management's Response

Management's actions are responsive to the recommendation, and we consider the recommendation closed for reporting purposes. However, we believe the SMA functions will require close monitoring, particularly as NASA heads into the retirement phase of the Shuttle Program. We will continue to monitor NASA's implementation of SMA, focusing on the concerns identified in this report.

Appendix A. Scope and Methodology

Scope and Methodology

We performed field work at NASA Headquarters, Kennedy and Johnson Space Centers, and Marshall Space Flight Center. We reviewed various draft plans leading to the March 7, 2005, "NASA Plan for Implementing Safe and Reliable Operations." We also reviewed the following NASA guidance documents:

- NPD 1000.3B, "The NASA Organization," dated July 30, 2004;
- Draft NPD 1240.4, "NASA Technical Authority," dated November 23, 2004;
- Draft NPR 1240.1, "NASA Technical Warrant System," dated November 23, 2004; and
- NASA Interim Directive, "Responsibilities of Program/Project Managers in the NASA Technical Warrant System," dated December 21, 2004.

We reviewed internal and external reports related to NASA's organizational structure, SMA reporting and funding concerns, and independent verification of Agency programs and processes. The specific reports reviewed include:

- "Report of Roles, Responsibilities, and Structures Team," (Clarity Team), June 24, 2004
- "Report of the President's Commission on Implementation of United States Space Exploration Policy," (Aldridge Report), June 2004
- "Columbia Accident Investigation Board Report," August 2003
- "One NASA Initiative Report," March 2003
- "NASA Space Shuttle Independent Assessment Team Report," March 7, 2000
- GAO Report NSIAD-90-187, "Space Program Safety: Funding for NASA's Safety Organizations Should Be Centralized," August 1990
- "Report of the Presidential Commission on the Space Shuttle Challenger Accident (Rogers Commission)," June 1986

We interviewed engineering, SMA, and Space Shuttle Program representatives from NASA Headquarters, Kennedy Space Center, Johnson Space Center, and Marshall Space Flight Center. We attended Aerospace Safety Advisory Panel sessions.

Appendix A

Management Program Control Review

The scope of the audit was limited to a review of the Agency plans to address engineering and SMA weaknesses as identified by the CAIB.

Audit Work

We performed audit work for this report from October 2003 through June 2005 and in accordance with generally accepted government auditing standards.

Appendix B. Management's Response

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

July 15, 2005

Reply to Attn of: Office of Safety and Mission Assurance

Moose

TO: Office of Inspector General

FROM: Chief, Safety and Mission Assurance

SUBJECT: Comments from Draft Report, "Review of Selected NASA Organizational Issues Related to the Space Shuttle Columbia Accident"

The Office of Safety and Mission Assurance (OSMA) provided comment to your office on May 4, 2005, regarding the discussion draft audit report, A-04-004-00, "Risks Associated with NASA's Plan for Technical Authority and Safety and Mission Assurance." From the later June 28, 2005, draft report, one recommendation for corrective action was made to the Chief, Safety and Mission Assurance (SMA) Office as follows: **The NASA Chief SMA Officer should demonstrate that there is a healthy, sustainable, independent oversight function at the Centers.**

Day-to-day accountability for SMA activities at a Center belongs to the Center Director in accordance with NASA's philosophy for managing mission support functions and in line with reasonable decentralized, practical management procedures, accepted widely in today's organizations both inside and outside of government. The Chief SMA Officer closely monitors the effective pursuit of all SMA functions across the Agency and ensures oversight of program and institutional operations is independent and thorough. NASA policy dictates that everyone in NASA is responsible for the safety of their individual actions, and that line and program leadership is to be held accountable for the safety of operations entrusted to their control to the extent of their authority and capability. One cannot be held accountable if not assigned responsibility.

The new Administrator has stated his intent, for organizing the Agency so that each Center Director will report directly to the Administrator's organizational box. This will provide an even greater degree of independence of authority between the program and the Center SMA organizations.

We appreciate the efforts of your audit and its intent as well as your belief that this will assist in the improvement of the Agency's safety posture. We concur with the recommendation and have determined that actions already taken or underway by the OSMA demonstrate a will for providing strong oversight of Center SMA functions. We will adhere to the suggestions made earlier by our response to the discussion draft. Actions to be taken include: 1) the expansion of

Final Report Reference

the scope of OSMA audits to include all forms of safety communications, not just those in the SMA world, and 2) the possibility for increasing the ratio of "field time" to "Washington time" for our Headquarters-based Center and program point of contacts.

Also, the following is some additional feedback from the Office of the Chief Engineer regarding some errors that they would like to see corrected in the report.

> "The statement that the NPD and NPR were withdrawn is incorrect and should be deleted. The Administrator's letter of November 23, 2004, directing implementation of Independent Technical Authority (ITA) using these draft documents is still being followed. Office of Chief Engineer believes this is an important point in that ITA is still following approved procedures. Also the statement with regards to Technical Warrant Holders (TWAs) recusing themselves from decisions on work that they had a prior involvement is not a requirement of ITA and should be deleted. TWAs when making their ITA decisions are independent which is defined as 1) not organizationally reporting to the PM, 2) not being funded by the PM and 3) receiving their authority from the Chief Engineer by a warrant."

Revised

Deleted

Please contact the OSMA Audit Liaison Representative, Kelly Kabiri, if you have any questions. Any questions on ITA, please notify Mr. Walter Hussey on 202-358-0591.

Bryan O'Connor

Bryan O'Connor

cc:
Office of Chief Engineer/Mr. Geveden
/Mr. Hussey
Office of Institutions and Management/Mr. Roberts
Kennedy Space Center/Ms. Massey

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Appendix C. Report Distribution

National Aeronautics and Space Administration (NASA) Headquarters

Administrator
Deputy Administrator
  Administrator Staff Offices
Chief Safety and Mission Assurance Officer
Chief Education Officer
Associate Deputy Administrator for Systems Integration
Chief Scientist
Chief Health and Medical Officer
Director of Advanced Planning
  Mission Offices
Exploration Systems Associate Administrator
Space Operations Associate Administrator
Science Associate Administrator
Aeronautics Research Associate Administrator
  Mission Support Offices
Chief Financial Officer
Chief Information Officer
Chief Engineer
Associate Administrator for Institutions and Management
  Assistant Administrator for Infrastructure and Administration
    Director, Management Systems Division
  Assistant Administrator for Institutional Planning and Investment
  Assistant Administrator for Procurement
  Assistant Administrator for Security and Program Protection
  Assistant Administrator for Human Capital Management
  Assistant Administrator for Diversity and Equal Opportunity
  Assistant Administrator for Small and Disadvantaged Business Utilization
General Counsel
Acting Chief of Strategic Communications

NASA Advisory Officials

Chair, NASA Advisory Council
Chair, Aeronautics Research Advisory Committee
Chair, Aerospace Medicine and Occupational Health Advisory Committee
Chair, Aerospace Safety Advisory Panel
Chair, Biological and Physical Research Advisory Committee
Chair, Earth System Science and Applications Advisory Committee
Chair, Education Advisory Committee

Chair, Exploration Systems Advisory Committee
Chair, Financial Audit Committee

NASA Advisory Officials (cont'd)

Chair, Minority Business Resource Advisory Committee
Chair, NASA Operations Council
Chair, Planetary Protection Advisory Committee
Chair, Return to Flight Task Group
Chair, Space Flight Advisory Committee
Chair, Space Science Advisory Committee
Chair, NASA Strategic Planning Council

NASA Centers

Director, Ames Research Center
Director, Dryden Flight Research Center
Director, John H. Glenn Research Center at Lewis Field
Director, Goddard Space Flight Center
Director, Jet Propulsion Laboratory
Director, Lyndon B. Johnson Space Center
Director, John F. Kennedy Space Center
  Chief Counsel, John F. Kennedy Space Center
Acting Director, Langley Research Center
Director, George C. Marshall Space Flight Center
Director, NASA Engineering and Safety Center
Director, John C. Stennis Space Center

Non-NASA Organizations and Individuals

Office of Management and Budget
  Deputy Associate Director, Energy and Science Division
    Branch Chief, Science and Space Programs Branch
Government Accountability Office
  Director, Defense, State, and NASA Financial Management, Office of Financial Management and Assurance
  Director, NASA Issues, Office of Acquisition and Sourcing Management

Appendix C

Congressional Committees and Subcommittees, Chairman and Ranking Minority Member

Senate Committee on Appropriations
  Senate Subcommittee on Commerce, Justice, and Science
Senate Committee on Commerce, Science, and Transportation
  Senate Subcommittee on Science and Space
Senate Committee on Homeland Security and Governmental Affairs
House Committee on Appropriations
  House Subcommittee on Science, State, Justice, and Commerce
House Committee on Government Reform
  House Subcommittee on Government Management, Finance, and Accountability
House Committee on Science
  House Subcommittee on Space and Aeronautics

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