National Aeronautics and
Space Administration

Office of Inspector General
Washington, DC 20546-0001

May 13, 2005

TO: Director, John F. Kennedy Space Center

FROM: Assistant Inspector General for Auditing

SUBJECT: Final Memorandum on NASA's Plans and Actions to Improve Kennedy Space Center Quality Assurance, Assignment Number A-04-018-00 Report Number IG-05-018

The Office of Inspector General (OIG) audited NASA's progress in addressing the Columbia Accident Investigation Board (CAIB) observations related to quality assurance (QA) processes and procedures for Shuttle operations at the Kennedy Space Center (Kennedy). The OIG conducted this audit because, as stated in the CAIB report, a strong QA program is necessary to prevent future accidents. Details regarding the audit objectives, scope, and methodology are in Enclosure 2.

The CAIB made four primary observations (10.4-1 through 10.4-4) and one supplemental observation (CAIB Report Volume II, Appendix D.a, "Supplement to the Report") relating to QA processes and procedures for Shuttle operations at Kennedy. We found that NASA had made satisfactory progress in addressing the four primary CAIB observations. However, we found that NASA's response to the supplemental observation was insufficient and this report includes one recommendation addressing the deficiency.

The CAIB observations and NASA's actions in response to those recommendations are addressed in the following sections.

CAIB Observation 10.4-1. CAIB Observation 10.4-1 states: "Perform an independently led, bottom-up review of the Kennedy Quality Planning Requirements Document (QPRD) to address the entire quality assurance program and its administration. This review should include development of a responsive system to add or delete government mandatory inspections."

Kennedy is addressing the QPRD bottom-up review as a two-step process. First, Kennedy established an independent team to assess the Government Mandatory Inspection Point (GMIP)[1] process. The team issued a final report in January 2004 addressing GMIP policy, process, and workforce related issues. The report identified 23 action items to improve Kennedy's GMIP process, none of which were considered critical to shuttle return-to-flight. The actions involved establishing, revising, or clarifying Kennedy GMIP policies and processes, assessing and consolidating GMIP

[1]GMIP is a point in the contractor shuttle processing where the Government inspects hardware or processes for nonconformance.

related systems and databases, and identifying and implementing improvements to the GMIP workforce. As of May 11, 2005, nine actions remained opened and are expected to be completed by June 30, 2005.

Secondly, Kennedy initiated a baseline review of the QPRD by assessing whether GMIPs were adequate for the orbiter, external tank, booster, and main engine hardware systems. If they are not adequate, GMIPs will be added or deleted based on criticality. (Criticality is used to categorize the effect of hardware failure or loss of a given function.) The baseline review of the QPRD process is expected to be completed by May 20, 2005.

The Agency's actions are responsive to the CAIB observation.

CAIB Observation 10.4-2. CAIB Observation 10.4-2 states, "Kennedy's QA programs should be consolidated under one Mission Assurance office, which reports to the Center Director."

In response to this observation, Kennedy reorganized its QA programs under one organization—the Mission Assurance Office, which reports to the Center Director. The new organization was formally established in April 2004 with issuance of KDP B-1041, entitled "John F. Kennedy Space Center Business Objectives and Agreement for the Safety and Mission Assurance [SMA] Directorate." The reorganization established the SMA Directorate as the sole provider and focal point for planning and executing center and program SMAs at Kennedy.

The Kennedy reorganization, which consolidated its QA function, is responsive to the CAIB observation.

CAIB Observation 10.4-3. CAIB Observation 10.4-3 states, "Kennedy QA management must work with NASA and perhaps the Department of Defense to develop training programs for its personnel." That observation was based on the CAIB finding that most of the training for quality engineers, process analysts, and QA specialists was on-the-job training rather than formal training.

In November 2003, in response to this observation, Kennedy formed a team of engineers and QA specialists from both the Space Shuttle and International Space Station Programs to develop and document a training plan. The team worked with the Defense Contract Management Agency (DCMA) and QA training contractors at DCMA to benchmark the DCMA training program. The team evaluated courses on QA skills and visual inspection to develop a comparable training program for Kennedy inspectors. The benchmark activity with DCMA was completed in April 2004.

Based on the benchmarking results, Kennedy established a formal training curriculum entitled "Safety and Mission Assurance Directorate Development Training Curriculum, Kennedy Space Center Users Guide 2801," dated October 8, 2004. That document provides a comprehensive training plan for QA personnel that defines training and development requirements and identifies a minimum level of training, knowledge, and

skills. The document also establishes three training levels (basic, intermediate, and advanced) for QA positions and institutes a process for progressive qualification at each level. Kennedy is scheduled to complete training personnel in accordance with the new curriculum by August 2005. We did not evaluate the adequacy of the resultant training program as part of our review.

The Agency's actions are responsive to the CAIB observation.

CAIB Observation 10.4-4. CAIB Observation 10.4-4 states, "Kennedy should examine which areas of International Organization for Standardization (ISO) 9000/9001 truly apply to a 20-year-old research and development system like the Space Shuttle."

ISO 9000 identifies quality management principles used to lead an organization toward processes that improve performance. Quality management principles form the basis for the standards within the ISO. Internal and external parties can use international standards to assess the ability of an organization to meet customer, regulatory, and the organization's own requirements. ISO 9001 certification means that an organization has a quality management system in place that meets the minimum requirements of the ISO. Once the quality management system is in place, benefits can be realized through continuous use and improvement of system products and service quality as well as maximizing the effectiveness and efficiency of the system processes.

Kennedy has made limited progress in addressing Observation 10.4-4 because of higher priority return-to-flight actions. The team that Kennedy assembled to review use of ISO 9000/9001 in response to CAIB Observation 10.4-4 met for the first time in September 2003. The team was originally scheduled to complete its review and submit its final deliverable by August 4, 2004. However, several delays have taken place, and the review is not complete. According to the most recently published document, "NASA's Implementation Plan for Space Shuttle Return to Flight and Beyond," dated March 18, 2005, the team established the following milestone schedule:

- ISO 9000/9001 applicability to United Space Alliance Kennedy operations, due January 2005 (milestone schedule was not updated since the previous version);
- Proper usage of standard in evaluating contractor performance, due January 2005 (milestone schedule was not updated since the previous version);
- Current usage of standard in evaluating contractor performance, due March 2005;
- Future usage of standard and changes to surveillance or evaluation of contractor, due March 2005; and
- Presentation of review, due March 2005.

As of May 13, 2005, the actions remain open. Kennedy management officials and QA personnel stated that the significant schedule slips for completing the review occurred because they assigned the action a low priority because other CAIB issues were deemed more critical.

CAIB Supplemental Observation. The CAIB was concerned that stand-alone recommendations that were not annotated as return-to-flight issues may not be adequately addressed. Therefore, the "Supplement to the Report," contained in CAIB Report Volume II, Appendix D.a, augmented the CAIB report. One of the Supplemental Observations that relates to CAIB Observation 10.4-3 states, "An evaluation of the disparity of [QA specialist] civilian grades at Kennedy Space Center compared to other NASA centers should be accomplished to determine whether the current grade levels are appropriate." Kennedy is the only NASA center that has QA specialists graded at general schedule (GS) pay scale 11. All other NASA centers have QA specialists graded at GS-12.

In July 2003, in response to the CAIB Supplemental Observation, the Chief of Kennedy's Office of Human Resources Management and Development analyzed Kennedy's QA specialist positions by comparing the Kennedy QA specialist position description to QA specialist position descriptions at other NASA centers. Based on that comparison, he determined that Kennedy's QA specialist positions were graded at the appropriate level. However, Kennedy's grade level analysis was faulty because they failed to follow Office of Personnel Management (OPM) and related statutory procedural requirements by improperly using outdated and obsolete position descriptions to perform the analysis. The analysis was also faulty because they improperly classified the Kennedy QA positions based upon position description comparisons.

The OPM "General Schedule Position Classification Standards" dated August 1991 states that a position description should contain the major duties, responsibilities, and supervisory relationships of a given position and must be kept up to date. However, the QA specialist position description that Kennedy used in its analysis had not been updated in 7 years and did not include some of the major duties Kennedy QA specialists are currently responsible for. According to several QA specialists we interviewed at Kennedy, examples of duties they perform not listed in their position descriptions include the performance of quality assurance inspections, hardware surveillance, and orbiter major modification surveillance.

In addition, section 5107 ("Classification of positions"), title 5 ("Government Organization and Employees"), of the United States Code prohibits classification of positions based upon position description comparisons. Instead, agencies must grade positions based on an analysis of the actual content of the work. That is critical because, as stated in OPM's classification standards guidance, "while the tasks [identified in the respective position descriptions] might seem to be similar, the complexity of the work, as well as the level of responsibility, authority, level of contacts, purpose of contacts, and so on, could be different and justify different classifications." However, rather than evaluating the content of the work to determine the appropriate grade level, reviewers in

the Office of Human Resources Management and Development at Kennedy determined the appropriate grade level by comparing the position description of QA specialists at Kennedy with the position descriptions of QA specialists at other NASA centers.

In September 2004, in response to our audit findings, Kennedy senior-level human resources specialists performed approximately ten individual desk audits for QAS positions at the Center to determine whether work was being performed at the GS-12 level. Based on the results of the desk audits, Kennedy determined that the journeyman level of GS-12 was justifiable for the QAS positions. In November 2004, Kennedy finalized evaluation criteria and an implementation plan for Center QAS managers to use in determining the operational performance level of each QAS employee.

Recommendation for Corrective Action
(recommendation revised from draft based on management's comments)

1. **We recommend that Kennedy's Office of Human Resources Management and Development perform an assessment regarding the appropriate grade level of each Center QAS employee.**

Management's Response. Management concurred with the recommendation and has completed its assessment of each Center QAS employee's grade level. Based on the results of its assessment, Kennedy has initiated personnel actions to promote those QAS employees who were assessed as performing at the GS-12 level. For those QAS employees who were assessed as not performing at the GS-12 level, Center QAS managers are implementing individual development plans to provide those employees an opportunity to achieve journeyman (GS-12) level.

The complete text of management's response is in Enclosure 3.

Evaluation of Management's Response. Management's actions are responsive to our recommendation, and the recommendation is closed.

We appreciate the courtesies and cooperation provided to the staff during this review. If you have questions, please contact Mr. Joseph Kroener, Director, Procurement Audits, at (202) 358-2558.

Evelyn R. Klemstine

Evelyn R. Klemstine

Enclosures

cc:
General Counsel/Mr. Wholley
Associate Administrator for Space Operations Mission Directorate/Mr. Readdy
Audit Liaison Representative, Office of Space Operations/Mr. Roberts
Chief Safety and Mission Assurance Officer/Mr. O'Connor
Office of Human Capital Management/Ms. Novak
Associate Administrator for Institutions and Management/Mr. Jennings
Audit Liaison Representative, Office of Infrastructure, Management and Headquarters Operations/Mr. Sutton
KSC/SA/Director, Safety and Mission Assurance Directorate
KSC/CC/Chief Counsel
KSC/QAD/Audit Liaison Representative
KSC/SA-B/Chief, Shuttle Division

Recommendation Status

Recommendation	Resolved	Unresolved	Open/ECD*	Closed
1	X			X

*ECD – Estimated Completion Date.

Objectives, Scope, and Methodology

Objectives

The overall objective of the review was to determine whether NASA is adequately addressing the CAIB findings and observations regarding QA processes and procedures related to Shuttle operations at Kennedy. Specific objectives of the review included determining whether NASA had (1) performed a bottom-up review of the QPRD, which included the development of a responsive system that identifies criteria for adding or deleting GMIPs; (2) consolidated QA programs under one Mission Assurance office that reports directly to the Center Director; (3) developed training programs for its inspectors; and (4) determined which areas of the ISO 9000/9001 appropriately apply to the Space Shuttle. We also determined whether NASA had adequately evaluated the disparity of Quality Assurance Specialist civilian grades at Kennedy Space Center compared to other NASA centers to determine whether the current grade levels are appropriate.

Scope and Methodology

To review the Agency's plans regarding QA processes and procedures relating to Shuttle operations, we conducted interviews with key NASA personnel involved in implementing the recommendations of the CAIB. We determined the status of Kennedy's planned actions. We evaluated actions that were planned and in progress to determine if those plans adequately address the CAIB concerns with the Kennedy QA program, its administration, and development of a responsive system to add or delete GMIPs.

We reviewed consolidation plans to determine whether the plans will integrate the QA process and organize the QA programs under one Mission Assurance office reporting directly to the Center Director. We also reviewed Kennedy's evaluation of the appropriateness of the grade level for QA specialists and training plans for inspectors to ensure they will adequately address CAIB concerns. We interviewed individuals responsible for developing the training plans for inspectors. In addition to interviewing individuals responsible for examining whether ISO 9000/9001 applies to the Space Shuttle, we reviewed action plans to determine ISO 9000/9001 applicability and ensure they will adequately address CAIB concerns.

We reviewed CAIB Report Volume II, Appendix D.a, "Supplement to the Report," as it relates to CAIB Observation 10.4-1 through Observation 10.4-4. Appendix D.a augments the Board Report and the condensed list of recommendations. The document includes two recommendations and a supplemental observation, as follows.

First Recommendation

> "(Note: This item is currently Observation O10.4-1 in the Board report. Due to the potential gravity of this item, it is urged this become a return-to-flight Recommendation.) Perform an independently led, bottom-up review of the

Kennedy Space Center Quality Planning Requirements Document to address the entire quality assurance program and its administration. This review should include development of a responsive system to add or delete government mandatory inspections. Suggested Government Mandatory Inspection Point (GMIP) additions should be treated by higher review levels as justifying why they should not be added, versus making the lower levels justify why they should be added. Any GMIP suggested for removal need concurrence of those in the chain of approval, including responsible engineers."

Second Recommendation

"(Note: Like the preceding item, this item is currently a subset of Observation O10.4-1 in the Board report; while it is urged this become a Recommendation, it does not need to be characterized as a return-to-flight recommendation.) Kennedy Space Center must develop and institutionalize a responsive bottom-up system to add to or subtract from Government Inspections in the future, starting with an annual Quality Planning Requirements Document review to ensure the program reflects the evolving nature of the Shuttle system and mission flow changes. At a minimum, this process should document and consider equally inputs from engineering, technicians, inspectors, analysts, contractors, and Problem Reporting and Corrective Action to adapt the following year's program."

Supplemental Observation

An evaluation of the disparity of Quality Assurance Specialist civilian grades at Kennedy Space Center compared to other NASA centers should be accomplished to determine whether the current grade levels are appropriate.

Our audit was limited to addressing QA-related observations and recommendations that pertained to Kennedy. We did not evaluate responses to supplemental recommendations related to the Michoud Assembly Facility.

Management Controls Reviewed

An assessment of management controls was not part of the review objectives; however, we observed that all levels of management were involved in NASA's efforts to satisfy return-to-flight concerns regarding Kennedy QA.

Use of Computer-Processed Data

We did not use computer generated data to perform this audit.

Review Work

We performed audit work from February 2004 through April 2005 in accordance with generally accepted government auditing standards.

National Aeronautics and
Space Administration
John F. Kennedy Space Center
Kennedy Space Center, FL 32899

March 25, 2005

Reply to Attn of: SA

TO: NASA Headquarters
Attn: Assistant Inspector General for Auditing

FROM: AA/Director

SUBJECT: Draft Memorandum on NASA's Plans and Actions to Improve Kennedy Space Center Quality Assurance, Assignment Number A-04-018-00

Thank you for sharing your insights and findings regarding the improvement of Kennedy Space Center Quality Assurance and for giving us the opportunity to comment on your Draft Memorandum dated March 4, 2005. We have thoroughly reviewed your findings and the related recommendation, and we concur. We have completed corrective action on the recommendation and request that it be closed upon issuance of the Final Report.

Our specific comments are enclosed. Should you require further information, please call Mr. Jim Nary at 321-867-7768, or send e-mail to James.E.Nary@nasa.gov.

James W. Kennedy

Enclosure

cc:
HQ/Chief Safety and Mission Assurance Officer/B. O'Connor
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RECOMMENDATION 1

The Director, Kennedy Space Center, should ensure that the position description (PD) for QA specialist is updated to reflect current responsibilities. Further, the updated position description should be provided to Kennedy's Office of Human Resources Management and Development and an evaluation of the position description should be performed, based on the content of the work, to determine whether Kennedy QA specialists are appropriately graded.

NASA RESPONSE

Concur. In July 2004, a career ladder Position Description (PD) was developed to reflect current responsibilities for the Quality Assurance Specialist (QAS) positions at Kennedy Space Center (KSC) with a proposed journeyman level of GS-12. The updated PD was evaluated and a general study was conducted by a qualified Human Resources Specialist, who also serves as an advisor to the Safety and Mission Assurance (S&MA) Directorate. Based on this evaluation and study, it was determined that the journeyman level of the QAS should be at the GS-12 level. The career ladder PD (GS-5 through GS-12) was classified in August 2004.

In September 2004, individual, in-depth desk audits were undertaken for QAS positions by Senior Human Resource Specialists to determine whether work was being performed at the GS-12 level. Upon completion of approximately ten desk audits, it was determined that the journeyman level of a GS-12 was justifiable. Findings revealed that QAS positions demonstrating "independence in planning audits" for 25 percent or greater of the position's time could, in fact, meet the GS-12 level, according to the OPM Position Classification Standard for Quality Assurance Series, GS-1910, TS-67, dated March 1983. Although findings revealed that some QAS positions audited were not yet spending 25 percent or greater time toward independence in planning audits, projected new work was anticipated to increase throughout the QAS community as a result of newly implemented surveillance audit programs.

In November 2004, evaluation criteria and an implementation plan were finalized for the QAS managers to complete in order for the Human Resources organization to determine the operational level of each QAS. The criteria for a GS-12 level included referencing performance of independent auditing.

In February 2005, all current QASs were reassigned to the appropriate grade level career ladder PD. Meetings were held with QAS managers to determine eligibility for each QAS position to the GS-12. Both the QAS managers and the Human Resources Specialist (who also serves as an advisor to the S&MA Directorate) signed an approval sheet for those positions which were currently operating at the GS-12 level. On March 11, 2005, Human Resources management concurred with the decision to promote those QASs who were operating at the GS-12 level. Promotions are currently in work for the approved positions. For those individuals who are not yet performing at the GS-12, QAS managers are implementing Individual Development Plans (IDPs) to enable the employees the ability to achieve journeyman (GS-12) level.

Based on corrective action and work completed, KSC requests that this recommendation be closed upon issuance of the Final Report for the subject audit.

Action was completed on March 11, 2005.
Projected Corrective Action Closure Date: Upon issuance of Final Report by OIG

Enclosure