National Aeronautics and
Space Administration

Office of Inspector General
Washington, DC 20546-0001

November 10, 2010

TO: Bryan O'Connor
Chief of Safety and Mission Assurance

Michael Wetmore
Director, Safety and Mission Assurance, Kennedy Space Center

FROM: Paul K. Martin
Inspector General

SUBJECT: Final Memorandum Assessing Launch Services Program's Interim Response Team Training Requirements (Report No. IG-11-003; Assignment No. A-09-011-01)

During our audit of NASA's Launch Services Program (Assignment A-09-011-00), the Office of Inspector General received an allegation that Launch Services personnel were not properly trained to investigate launch vehicle mishaps.

The Kennedy Space Center's Safety and Mission Assurance Directorate is responsible for defining the roles and responsibilities associated with mishap preparedness and contingency plans (mishap plans) for the Launch Services Program. Mishap plans, which are prepared at the Headquarters, Center, program, and project levels, describe the procedures to report, investigate, and record mishaps and close calls, to include those that occur during launch emergencies.[1] The response team is considered "interim" because it operates on a short-term basis and concludes its mishap-response activities when the official NASA-appointed investigating authority arrives at the scene and takes control. Although launch emergencies and mishaps at Kennedy are rare, team members must be properly trained to support the initial phases of a mishap investigation.[2]

[1] NASA defines a mishap as an unplanned event that results in injury to personnel or damage to property. NASA categorizes mishaps based on the severity of injury to personnel or total cost of damage to property. Mishap classifications range from a Type A mishap, the most severe, to a close call, the least severe.

[2] The Launch Services Program's Interim Response Team was activated in April 2005 when the Demonstration of Autonomous Rendezvous Technology spacecraft collided with the intended rendezvous satellite and again in February 2009 when the Orbiting Carbon Observatory crashed into the ocean following a launch failure.

To assess the allegation about a lack of adequate training for response team members, we reviewed training requirements for the Kennedy Interim Response Team in the relevant mishap plans (Science Mission Directorate, Exploration Systems Mission Directorate, Kennedy Space Center, and Launch Services Program). See Enclosure 1 for details on the review's scope and methodology.

Executive Summary

While the mishap plans we reviewed appropriately identified roles and responsibilities for managing contingency actions, NASA has not established training requirements for Interim Response Team members.[3] In addition, we found that training requirements for Interim Response Team members in the Launch Services Program's mishap plan were inconsistent with mishap plans developed by Kennedy Space Center, the Science Mission Directorate, and the Exploration Systems Mission Directorate. We also determined that none of the 16 safety and mission assurance personnel assigned as Kennedy Interim Response Team members during the Orbiting Carbon Observatory (OCO) and Lunar Reconnaissance Orbiter/Lunar Crater Observation and Sensing Satellite (LRO/LCROSS) launch missions had completed all of the required training included in the mission-specific mishap plans, and only 3 of the 16 had completed the "Introduction to Mishap Investigations" training course required by the Kennedy Mishap Plan. Consequently, we question whether personnel assigned as Interim Response Team members were sufficiently knowledgeable about the NASA mishap investigation process to effectively execute the assigned roles and responsibilities of the Interim Response Team in the event of a mishap or close call.

We provided a draft of this memorandum to the Agency on September 29, 2010, recommending that NASA's Chief of Safety and Mission Assurance develop minimum requirements for personnel assigned to Interim Response Teams and update NPR 8621.1B to reflect these requirements, and that the Director of Kennedy's Safety and Mission Assurance Directorate develop procedures to ensure that assigned personnel complete the required training.

The Chief of Safety and Mission Assurance concurred with our recommendations and stated that the Office of Safety and Mission Assurance (OSMA) will update the NPR to to include general training requirements for safety and mission assurance personnel assigned to Interim Response Teams as well as a requirement that Mishap and Contingency Plans specify additional training requirements appropriate to the hazards and tasks associated with a particular Center or program. The Chief also concurred with our recommendation that the Director of Kennedy's Safety and Mission Assurance Directorate develop procedures to ensure that personnel assigned to Interim Response Teams complete the required training. The Chief stated once NPR 8621.1 is updated, the

[3] NASA Procedural Requirements (NPR) 8621.1B, "Mishap and Close Call Reporting, Investing, and Recordkeeping," May 23, 2006.

Kennedy Safety and Mission Assurance Directorate will ensure that its process includes the updated applicable training requirements. The full text of NASA's comments is reprinted in Enclosure 2.

We consider the Chief's proposed actions to be responsive to our recommendations. Therefore, the recommendations are resolved and will be closed upon verification that management has completed the corrective actions.

Background

NASA Mishap Plans. NASA's Chief of Safety and Mission Assurance is responsible for developing and updating NASA's principal regulatory guidance, NPR 8621.1B, to ensure the proper reporting, investigating, and recordkeeping for all NASA mishaps and close calls. The NPR defines NASA's mishap reporting and investigative processes and requires that OSMA provide mishap investigation training and identify mishap investigation tools. The NPR also provides detailed requirements on how to respond to any close call, from discovery through corrective action and closure; establishes investigation authorities; formalizes notification, analysis, and reporting obligations; and describes organizational responsibilities for developing mishap plans at the Headquarters, Mission Directorate, Center, program, and project levels. These mishap plans supplement NPR 8621.1B and identify appropriate roles and management responsibilities for local mishap and close call notification, reporting, investigating, recording, and prevention policies and procedures. NPR 8621.1B also identifies mandatory requirements for each supplementary mishap plan and describes how the plans are to be consistent with each other and cover any special organizational procedures.

Mishap Preparedness and Contingency Plans. NPR 8621.1B establishes specific requirements to ensure proper reporting, investigating, and recordkeeping for mishaps and close calls. The NPR directs Center Directors to develop a mishap plan to include procedures to report, investigate, and record mishaps and close calls under the Center's responsibility and describe when the Center's mishap plan is superseded by another NASA mishap plan.

The Kennedy Safety and Mission Assurance Directorate is the focal point for planning and executing Center and Program safety and mission assurance activities at Kennedy, including coordination with OSMA at NASA Headquarters, other Centers, and other Government agencies. The Kennedy Safety and Mission Assurance Directorate is responsible for defining the roles and responsibilities associated with Kennedy's and the Launch Services Program's mishap plans, as well as the specific requirements and procedures for reporting, responding to, and investigating mishaps.

The "Kennedy Space Center Mishap Preparedness and Contingency Plan" (KSC-PLN-2807, March 27, 2008) contains all the requirements established by NPR 8621.1B. Each organization identified as having a participatory role in reporting, responding to, and investigating mishaps is required to develop procedures to supplement

the plan. The Kennedy Space Center Director is the approving authority for the Kennedy mishap plan.

"Launch Services Program Mishap Preparedness and Contingency Plan" (LSP-PLN-365.01, August 22, 2006) defines the program requirements, roles, and responsibilities for launch contingencies resulting in a mishap, mission failure, or close call. The Launch Services Program's mishap plan is in effect from the start of the launch vehicle "Countdown Call to Stations" and ends after verification of successful separation of the spacecraft from the launch vehicle and the reopening of the launch pad for normal operations. The Launch Services Program's mishap plan fulfills the NPR 8621.1B requirement for a contingency plan for launch-related mishaps and close calls.

Mission-specific mishap plans also describe how NASA programs and Centers work together to respond to and investigate NASA incidents, record results, and institute actions to prevent the recurrence of mishaps. The mission-specific mishap plans developed by the Science Mission and the Exploration Systems Mission Directorates that we reviewed for two NASA missions – OCO, LRO/LCROSS missions – provided for mission-unique requirements and complied with the Launch Services Program and Center mishap plans.

Interim Response Team. The Director of Kennedy's Safety and Mission Assurance Directorate activates the Interim Response Team when a launch vehicle suffers a mishap or close call. The team consists of representatives from Kennedy's Safety and Mission Assurance Directorate, the Launch Services Program Office, or both. The team serves until the official NASA-appointed investigating authority arrives at the scene to investigate the mishap or close call. Team members mainly review launch data integrity and accountability, identify and collect witness statements, and coordinate mishap activities among NASA, the Air Force, and contractors for the mishap launch vehicle.

Prior to the appointment of a formal investigating authority, Interim Response Team members' duties include assisting the NASA Launch Services Program officials to:

- prevent further injury to personnel or damage to property and safeguard appropriate records, data, property, and equipment; and

- ensure information flows to command post or emergency operations center and document the mishap scene using photography, video, sketches, and debris mapping, as applicable.

Upon arrival of the formal investigating authority, Interim Response Team members may also support the mishap investigation by collecting preflight, flight, and post-flight data, performing analysis to determine the probable cause of mission failure, and coordinating investigative actions with governmental and contractor organizations.

Interim Response Team Training Requirements are Inconsistent

We found that NPR 8621.1B describes specific training requirements for mishap investigators and specifies minimum training qualifications for the Investigating Authority members and advisors upon their assignment to a mishap investigation; however, the NPR does not specify training requirements for Interim Response Team members.

However, the Kennedy Center Mishap Plan directed Interim Response Team members to complete three training courses available through the online System for Administration, Training, and Educational Resources for NASA (SATERN): "Introduction to Mishap Investigations," "NASA Mishap Investigation" (a Kennedy-developed course), and "NASA Root Cause Analysis." The Launch Services Mishap Plan did not specify any training requirements for Team members, but did describe team roles and responsibilities. NPR 8621.1B directs NASA programs to establish training requirements for NASA employees appointed to serve as Interim Response Team members, but again does not identify specific training requirements. However, OSMA and NASA Engineering and Safety Center personnel we interviewed said at least one member of an Interim Response Team should be required to complete SATERN's "Introduction to Mishap Investigations" and be familiar with NASA's mishap investigation policies and procedures.

We reviewed the OCO and LRO/LCROSS mishap plans to identify what specific training was required for personnel assigned to the missions' Interim Response Teams. These mission-specific mishap plans required "Introduction to Mishap Investigations" training for all team members and six other specific training requirements not included in the Kennedy or Launch Services Program mishap plans.

The training requirements in the mission-specific plans were as follows:

- SATERN's "Introduction to Mishap Investigations";
- Blood Borne Pathogens;
- National Incident Management System Online Training;
- NASA Interim Response Team Video;
- NASA-sanctioned Witness Interviewing training;
- NASA-sanctioned Chain of Custody training; and
- NASA-sanctioned Evidence Collection training.

Safety and Mission Assurance training records for team members assigned to the three missions showed that only 3 of 16 members (19 percent) had completed any mishap investigation training within the last 3 years and no members had completed the Root

Cause Analysis training listed in the Kennedy Mishap Plan. As a result, we question whether personnel assigned as Interim Response Team members are sufficiently knowledgeable about the NASA mishap investigation process, a situation that could result in their inability to effectively execute team-assigned roles and responsibilities.

Mission Program Executives we interviewed said they expected Centers to assign team members who had the requisite mishap investigation training in addition to any mission-specific expertise. However, Launch Services Program personnel at Kennedy said that the investigation training in the Kennedy mishap plan was unnecessary because team members only collect mission data, evidence, and witness statements and therefore they eliminated these training requirements from the Launch Services Program's mishap plan. Because NPR 8621.1B did not address standard training requirements for Interim Response Team members, the Center, Launch Services Program, and mission-specific mishap plans had inconsistent training requirements that resulted in a lack of properly trained personnel assigned to the Interim Response Teams for the two NASA missions in our review.

Recommendations, Management's Response, and Evaluation of Management's Response

Recommendation 1. We recommended that the Chief of Safety and Mission Assurance develop standard mishap training requirements for safety and mission assurance personnel assigned to Interim Response Teams.

Management Response. The Chief concurred with developing standard mishap training requirements for Interim Response Team members and stated that the action will be completed by September 1, 2011.

Evaluation of Management's Response. Management's planned action is responsive. The recommendation is resolved and will be closed upon completion and verification of management's corrective action.

Recommendation 2. We recommended that the Chief of Safety and Mission Assurance update NPR 8621.1B, "NASA Procedural Requirements for Mishaps and Close Call Reporting, Investigating, and Recordkeeping," to include the training requirements for personnel assigned to Interim Response Teams. The training should be specific to the role of the team member and include refresher-training requirements for each course.

Management Response. The Chief partially concurred with our recommendation, stating that NPR 8621.1B will be updated to specifically include (a) general training requirements for personal assigned to Interim Response Teams, and (b) a requirement that Mishap Preparedness and Contingency Plans specify additional training requirements appropriate to the hazards and tasks associated with a particular Center or program. Action is to be completed by September 1, 2011.

Evaluation of Management's Response. Management's proposed actions to revise NPR 8621.1B are responsive. The recommendation will be closed upon completion and verification of management's corrective action.

Recommendation 3. Upon establishment of the above recommended training requirements for Interim Response Teams, we recommended that the Director of Kennedy's Safety and Mission Assurance Directorate develop procedures to ensure that personnel have the requisite training prior to being assigned to Interim Response Teams.

Management Response. The Chief of Safety and Mission Assurance concurred, stating that upon updating NPR 8621.1B with identified Interim Response Team training, the Director of Kennedy's Safety and Mission Assurance Directorate will ensure that Kennedy's existing process is updated to include those courses that are applicable to Kennedy Interim Response Teams. Action is to be completed by September 1, 2011.

Evaluation of Management's Response. Management's proposed action is responsive. The recommendation is resolved and will be closed upon completion and verification of management's corrective action.

We appreciate the courtesies extended during our review. If you have any questions or need additional information, please contact Raymond Tolomeo, Science and Aeronautics Research Director, Office of Audits, at 202-358-7227.

2 Enclosures

Scope and Methodology

During an audit of NASA's Launch Services Program that examined whether NASA's Launch Services Program acquired expendable launch vehicles cost effectively and timely, the Office of Inspector General received an allegation that Launch Services Program Interim Response Team members at Kennedy Space Center were not properly trained to investigate launch vehicle mishaps. In response to this allegation, we performed a review from March 2009 through September 2010 in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the review to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on the objectives. We believe that the evidence obtained during this review provides a reasonable basis for our findings and conclusions based on our objectives. Work performed for this review included:

- Reviewing and analyzing mishap guidance and plans prepared by the OSMA, Science Mission Directorate, Exploration Systems Mission Directorate, Launch Services Program, and Kennedy Space Center.

- Reviewing organizational roles and responsibilities for Interim Response Team members, NASA training requirements for Interim Response Team members, and NASA training requirements for its mishap investigation teams.

- Interviewing safety and mission assurance personnel at OSMA, NASA Engineering and Safety Center, and Kennedy.

- Interviewing Kennedy Flight Projects Office managers of the Launch Services Program.

- Interviewing Program Executives for the OCO and LRO/LCROSS launch missions.

- Attending the LRO/LCROSS Flight Readiness Review on June 10, 2009.

Computer-Processed Data. We did not use computer-processed data to examine the allegation that Launch Services Program's Interim Response Team members at Kennedy Space Center were not properly trained to investigate launch vehicle mishaps.

Review of Internal Controls. We reviewed and evaluated internal controls associated with the allegation and found deficiencies as described in the report. Implementation of the recommendations should improve the internal controls and prevent future recurrence.

Prior Coverage. During the last 5 years, there has been no audit coverage by the OIG of this particular issue.

Management's Comments

Final Reference

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

October 22, 2010

Reply to Attn of: Safety and Assurance Requirements Division

TO: Assistant Inspector General for Audits

FROM: Chief of Safety and Mission Assurance

SUBJECT: Response to Draft Memorandum Assessing Launch Services Program's Interim Response Team Training Requirements (Assignment No. A-09-011-01)

NASA has reviewed the Draft Memorandum Assessing Launch Services Program's Interim Response Team (IRT) Training Requirements (Assignment No. A-09-011-00) and has the following comments:

1. The ***Background*** section, second sentence, states, "The NPR [NPR 8621.1B] defines NASA's mishap reporting and investigative processes and requires that the Office of Safety and Mission Assurance (OSMA) develop mishap investigation training and identify mishap investigation tools." The word "develop" should be replaced with "provide." While OSMA develops courses in those cases where commercially available training is not available, NPR 8621.1B allows us to provide training developed by others. — Revised

2. Footnote 2 states that the Kennedy IRT was activated in April 2005 when the Demonstration of Autonomous Rendezvous Technology spacecraft collided with the intended rendezvous satellite and again in February 2009 when the Orbiting Carbon Observatory crashed into the ocean following a launch failure. This is not correct. The Launch Services Program IRT was activated for each of these two events (not the KSC IRT). — Revised

3. NASA concurs with Recommendation 1.

4. NASA partially concurs with Recommendation 2 and believes that it should be reworded as follows:

Update NPR 8621.1B, "NASA Procedural Requirements for Mishaps and Close Call Reporting, Investigating, and Recordkeeping," to include (a) general training requirements for personnel assigned to IRTs, and (b) a requirement that Mishap Preparedness and Contingency Plans specify additional training requirements appropriate to the hazards and tasks associated with a particular Center or Program. The training should be specific to the purpose of the IRT, and the need for refresher training shall be determined for each course.

NASA concurs on the need for training requirements for IRTs, but believes that the above wording better reflects the proper level of flexibility required for effective and efficient IRTs. Because of the difference in roles of various IRTs, it is appropriate to specify a minimum level of training and provide for additional training as required for the particular IRT. The NPR is currently in the process of being modified to specify minimum training requirements and a requirement to identify and implement other training as appropriate. Allowing time for the NASA On Line Directives Information System (NODIS) review process, we expect that these requirements will be in effect no later than September 1, 2011.

5. NASA concurs with Recommendation 3. A review by NASA of the LSP and the OCO Mishap Preparedness and Contingency Plans indicates that the personnel were in compliance with the requirements of the plans. When NPR 8621.1 is updated with identified training KSC will ensure that their existing process is updated to include those courses that are applicable to their IRTs.

6. NASA is also concerned that there is misunderstanding of the functional relationship of the various IRTs and MPCPs (LSP, Spacecraft, and KSC) and associated training requirements, along with Launch Range (Air Force) response plans that support the LSP launch of an assigned spacecraft. We will review our Agency Policy documentation and clarify these issues no later than September 1, 2011.

Thank you for the opportunity to comment on this Draft Memorandum.

FOR Bryan O'Connor

cc:
Office of Safety and Mission Assurance/Mr. Harkins
Dr. Stamatelatos
Mr. Greulich
Mr. Schumann
Ms. Kabiri
Associate Administrator for Space Operations Mission Directorate/Mr. Gerstenmaier
Ms. Brown
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