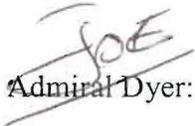




September 13, 2010

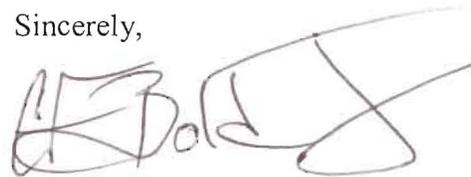
Vice Admiral Joseph W. Dyer, USN (Ret.)
Chair
Aerospace Safety Advisory Panel
National Aeronautics and Space Administration
Washington, DC 20546


Dear Admiral Dyer:

Enclosed are NASA's followup responses to previously addressed recommendations from the 2008 recommendations requested by the Aerospace Safety Advisory Panel (ASAP), the remaining 2009 Third Quarterly Meeting, and the 2010 First Quarterly Meeting. Please do not hesitate to contact me if the ASAP would like further background on the information provided in the enclosures.

I look forward to receiving continued advice from the ASAP that results from your important fact-finding and quarterly meetings.

Sincerely,



Charles F. Bolden, Jr.
Administrator

10 Enclosures:

1. NASA Follow-up Response to 2008-01-06
2. NASA Follow-up Response to 2008-02-07
3. NASA Response to 2009-03-03
4. NASA Response to 2009-03-05
5. NASA Response to 2010-01-01
6. NASA Response to 2010-01-02
7. NASA Response to 2010-01-03
8. NASA Response to 2010-01-07
9. NASA Response to 2010-01-08
10. Attachment

Tracking Number 2008-01-06
NASA Headquarters Mishap Investigation

ASAP Recommendation (Re-opened)

The NASA response adequately addresses the ASAP concern by specifying timelines that will ensure more timely reporting of mishap investigation results. Although the NASA response did not explicitly address the ASAP recommendation about appropriate experts to determine root causes, the Panel noted that “trained investigators” would meet a minimum of 45 workdays to successfully identify root causes for Type A and Type B mishaps, thus suggesting that the mishap investigation boards must include personnel with the necessary expertise.

Because a projected completion date of June 2009 was given for NASA actions, the ASAP requests that NASA conduct a follow-up briefing at the ASAP third quarterly meeting at the Jet Propulsion Laboratory (JPL) to update the status of the project and to present metrics on meeting these new deadlines, including a review of the Incident Reporting Information System and the NASA Safety Center Web sites, which ASAP members cannot access. NASA should clarify Action 2e, “all mishap reports will be posted within two workdays of their completion,” to indicate whether completion refers to investigation board activity or to release of the mishap report after receipt of NASA Headquarters endorsement.

NASA Response

NASA provided a presentation on this topic at the ASAP meeting on April 29, 2010, and includes the presentation as an attachment with this document. NASA also provided the requested status briefing at JPL in July 2009 and at Headquarters via teleconference in December 2009.

NASA conducted the requested evaluation of the NASA Procedural Requirements (NPR) 8621.1 requirement that states that a mishap investigation board has 75 workdays to complete their investigation to determine if the duration could be reduced to 30 workdays while still determining the root cause. In addition, in 2009, NASA conducted a review of NASA historical documents, performed an evaluation of the performance of mishap investigations over the last five years, and collected input from the Centers through the Mishap Investigation Working Group. After evaluation and input from all the Centers and the NASA Safety Center (NSC), NASA concluded that the majority of investigations for Type C and Type D mishaps and close calls can be completed successfully and shared with management within 30 workdays. Due to the complexity and scope of Type A and Type B mishaps, Agency Safety and Mission Assurance personnel determined that a maximum of 30 or 45 workdays was an insufficient amount of time to complete a root cause analysis, gather evidence for all root causes, and document all the findings and recommendations in a formal mishap investigation report. Centers were concerned about introducing a significant modification of the requirement for investigating Type A and Type B mishaps. Simple mishaps (e.g., single-person ladder fall) can be completed quickly. However, complex mishaps (e.g., rocket failure, satellite failure, complete building fires) require extensive analysis and testing which take more time. Larger cases require time to conduct engineering investigations and document all evidence in a detailed report. Based on a more

detailed study as discussed above, NASA will not change the requirement for Type A and Type B mishap reports. Appointing officials will be encouraged to conduct simple incident investigations in less than 75 workdays.

As indicated, NASA has initiated an update to NPR 8621.1 with the proposed changes as follows:

- a. For Type C and Type D mishaps and close call reports, NASA has proposed a reduction in the time allotted to complete the mishap report from 75 to 30 workdays.
- b. For Type A and Type B mishaps, NASA has proposed a change to the requirement from a 30 workday, publicly releasable status report to a 15 workday, publicly releasable status report. NASA will also propose to add requirements for proximate causes to be released in the 45-day status report, if they are available at that time.
- c. NASA proposed that the NSC will post all 15 workday publicly releasable status reports on the NSC Web site and the Mishap Investigation Web site.
- d. NASA proposed that within two workdays of receipt of the investigating authorities' signed report, the responsible Center safety office shall attach the electronic copy of the report in the Incident Reporting Information System. The NSC will verify that this has been completed. (This precedes the endorsement process and will be available to all civil service employees. The endorsed copy will also be posted upon completion of the endorsement process.)

Final changes to the NPR are dependent upon disposition of formal Agency comments and completion of the required Agency concurrence process.

Tracking Number 2008-02-07
Accident Review Timeliness

ASAP Recommendation - Part I

The ASAP urged that greater timeliness be achieved in completing accident reviews. The Panel also recommended that an organized and rigorous mishap trend analysis effort be undertaken agency-wide to identify causal trends at an Agency level as well as by Center. The results of this analysis should be briefed on a regular basis to senior Agency leadership. The Panel would like to see the Center analyses during their visits to field operations. The Panel recommended that a policy be implemented to brief senior leadership of initial causal analysis in a timely fashion after major mishaps. Finally, the Panel recommended that a closed loop management tracking system, similar to that used for ground mishaps, be developed to ensure implementation of lessons learned from flight failure investigations.

NASA Response

The NASA response dated March 15, 2010, to this recommendation indicates that NASA has completed several actions in various areas to revitalize its safety data management system. Improved processes have been instituted for performing root cause and trending analyses and to increase visibility of the statistics to executive management and Agency wide. The NASA response recommends closure on portions of the plan with two actions remaining open for completion this year, and the ASAP concurs with this status. What the ASAP finds still lacking in the NASA response is the executive summary that provides overall evidence that the timeliness of the entire accident investigation process starting with the initial report of the mishap occurrence and ended with the endorsement of the accident investigation board's report, including development and closeout of the corrective action plan, has improved.

The April 29, 2010, presentation (see the Attachment) provides the requested metrics that cover all parts of the mishap investigation process steps: 1) complete the investigation and mishap report, 2) review and endorse the mishap report, 3) develop a corrective action plan, 4) implement corrective actions, and 5) close the corrective action plan. NASA has made significant process improvements and reduced the time it takes to conduct mishap investigations and to endorse mishap reports, but as the presentation indicates, we still have room for improvement in the verification and closeout documentation for corrective actions. NASA is continuing to strengthen the mishap investigation process and ensure that quality reports are generated, effective recommendations are implemented to prevent future mishaps, and lessons learned are communicated throughout the Agency.

ASAP Recommendation - Part II

With regard to Recommendation 2008-02-07 concerning the process for investigating mission and test failures, NASA provided an excellent summary of the guidelines used in identifying and reacting to mission and test anomalies. In that discussion, two examples of "natural phenomena" were cited as not being considered mishaps to be investigated and learned from. The first was the International Space Stations (ISS) being struck by an unspecified size meteor. The second was NASA property damage resulting from weather such as lightning, high winds, snow loads,

flood and wildfire. While all of the conditions highlighted can sometimes be of such magnitude that they exceed established design limits and would legitimately qualify for a “natural phenomenon” exemption, it would appear that a blanket exemption for any natural phenomenon-related damage would miss those cases where proper design or administrative procedures should have been capable of protecting the assets, but failed to do so. Examples include damage allowed by defective lightning protection systems, flood damage caused by failure to maintain dikes in flood prone areas, structural building failure when exposed to predictable snow loads, trailers blown over by strong winds because they were not properly secured, and loss of the ISS from a micro meteoroid and orbital debris impact of a type and trajectory that should have been recoverable. The ASAP recommends that the “natural phenomenon” exemption be clarified to only apply to those events that exceed the intended capabilities of the applicable protective systems and procedures.

NASA Response

NASA considers this recommendation closed. In NPR 8621.1, NASA provides a limited exemption for natural phenomena. The NPR states that destruction of, or damage to, any property as a direct result of a natural phenomenon is not considered a mishap if the natural phenomenon is the proximate cause of the damage. There is a note in the NPR that indicates if a natural phenomenon is an intermediate cause or contributing factor, the exemption does not apply. Consequently, if there was a failure of an applicable protective system or procedure, and it was causal to the property damage or injury, then the exemption would not apply, and the incident would be classified as a mishap.

Additionally, NASA conducts many types of safety evaluations outside the mishap investigation process. When damage from natural phenomena is not considered a mishap, it is evaluated using other safety processes. Once damage has occurred from natural phenomena, NASA’s safety professionals review the situation and examine items such as the following:

- Was the notification program effective in assessing the potential issues?
- Does NASA have the correct controls and procedures in place to deal with the natural phenomena?
- Does new technology exist that could be utilized to minimize the consequence in the future?

Recommendations are implemented as appropriate, and the Centers share the lessons learned through working groups and meetings that address common issues.

Tracking Number 2009-03-03
Metrics on Mishap Investigation Board Report Authorization and Release from NASA Headquarters

ASAP Recommendation

There is continuing concern about the tracking and trending of administrative turnaround of reports at NASA Headquarters - specifically, the timeliness of getting the final authorization of the MIB report through the various offices at NASA Headquarters. The ASAP did not receive any particular metrics or statistics in this area. The Panel recommends that the NASA Headquarters Mishap Investigative Office continue to pull the data in this area together to determine whether the trend is in the right direction. A chart should be presented to the ASAP at the next meeting. A quarterly report on this topic is requested.

NASA Response

NASA provided a chart on this topic at the ASAP meeting on April 29, 2010, but, due to discussion of other topics, was not able to brief the data. The chart (page 10) is included as Enclosure 10 with this document. NASA will provide, as requested, a quarterly report on the mishap process metrics, similar to this attachment.

In ASAP's recent response related to timeliness of administrative turnaround of mishap reports at NASA Headquarters, they referred to the timeliness of getting the "final authorization" completed. NASA does not use the term "final authorization." Our terms and process descriptions are noted below:

- 1) Endorsement: NASA has established an endorsement process for all mishap reports. This process allows senior officials at NASA Headquarters and the Centers to review a mishap report, comment on the investigation findings, concur on recommendations, and determine if the investigation report is to be accepted or rejected. For Type A and Type B mishaps, the endorsing officials include the Appointing Official: either the Center Director (if the mishap occurred within a Center's gates) or the Associate Administrator of a Mission Directorate (if the mishap occurred outside the Center's gates and was under a major program's responsibility). Additionally, the report is reviewed and endorsed by the Chief, Safety and Mission Assurance, the Chief Engineer, and the Chief Health and Medical Officer (when there is an injury). NASA does not consider a report "endorsed" until all required endorsing officials have provided a written endorsement letter. For many major accidents, three or four endorsements, in addition to the appointing officials, are required. Even when all Headquarters endorsements are completed, the report is not considered officially endorsed until the Appointing Official has completed an endorsement.
- 2) Report Access by Civil Service Employees: As new information related to a mishap becomes available, it is attached to the Incident Reporting Information System (IRIS). As soon as a mishap report is signed by the investigating authority, it can be attached to IRIS. The mishap report in IRIS is considered NASA Sensitive But Unclassified (SBU) information.

This is because most mishap reports contain some elements of proprietary information, personnel information subject to the Privacy Act, Export Administration Regulations (EAR) information, and International Traffic in Arms Regulations (ITAR) information. However, all NASA SBU information is available to civil service employees in accordance with NASA Security Program Procedural Requirements (NPR 1600.1). Any NASA civil service employee can request a copy of the NASA mishap investigation report from their Center IRIS representative, as documented in the Center Mishap Preparedness and Contingency Plan.

- 3) Report Access by the Public: NASA has a process called “authorization for public release.” This process implements the requirements established by NPR 1600.1 and ensures that a mishap report is reviewed to determine if it is appropriate for release to the public. The “authorization for public release” does not impact the report’s distribution across the NASA civil service workforce, nor does it impact NASA’s ability to share lessons learned internally or initiate the implementation of corrective actions. If the report does not contain proprietary information, personnel information subject to the Privacy Act, EAR, ITAR, or other SBU information, it is eligible to be released to the public. Given that the majority of NASA’s mishap reports involve NASA contractor employee injuries, the contractor’s organization is consulted during the review to ensure that they agree that the report does not contain their proprietary information. The contractor’s organization is not bound by NPR 8621.1 to provide their response back to NASA in a timely fashion. The contractor’s legal advisor may take substantial time to review NASA’s report and determine when/if the report is to be released to the public.

Other NASA mishap investigation reports include detailed information about spaceflight hardware that is controlled via EAR and ITAR. Only a small percentage of NASA mishap reports is authorized for release. To date, 21 Type A and Type B reports have been placed in public domain via NASA Web sites and are all accessible at the NASA mishap investigation Web site.

Tracking Number 2009-03-05
Human Rating Requirements for Technical Standards

Recommendation

The Panel reiterates its previous Recommendation 2009-01-01-- “ASAP recommends that NASA formally establish and stipulate the direct link between the Human Rated Requirements (HRR) and the applicable NASA standards, such as the NASA-STD-5000 series of engineering directives as well as relevant technical standards,” and 2009-01-02-- “The ASAP recommends that NASA stipulate directly the HRR acceptable risk levels including confidence intervals for the various categories of activities (e.g., cargo flights, human flights) to guide managers and engineers in evaluating ‘how safe is safe enough.’ These risk values should then be shared with other organizations [Commercial Orbital Transportation Services] that might be considering the creation of human-rated transport systems so that they are aware of the criteria to be applied when transporting NASA personnel in space.”

NASA Response

Since the issuance of this recommendation, NASA has provided ASAP with a response to the earlier Recommendation 2009-01-01b. NASA completed implementation of the changes to NPR 8705.2, Human Rating Requirements, as indicated in its response in January 2010, and the recommendation has since been closed by ASAP.

On March 15, 2010, NASA also provided ASAP with an interim response to Recommendation 2009-01-02a, which outlines a process for the development of safety goals to answer the question “how safe is safe enough.” NASA is currently in the process of implementing its response by preparing a modification to NPR 8705.2 and developing protocols for the evaluation of safety performance. Depending on NASA’s internal review processes, NASA expects the change to the NPR to be completed by September 2010.

NASA requests that Recommendation 2009-03-05 be closed since the intent has been addressed within the closure of Recommendation 2009-01-01b, and the remaining elements are in work and being tracked to closure under Recommendation 2009-01-02a.

Tracking Number 2010-01-01
Research and Development of Safety and Mission Assurance (S&MA) Tools

ASAP Finding

For years, the aerospace world has been using the same fault-tree analyses, risk matrix assessments, preliminary hazard analyses, etc., that were developed in the Apollo era to identify and assess hazards and risks. There has rarely been enough time or funds to develop the new tools needed to identify and control hazards inherent in modern technologies such as software, firmware, and robotics, to name a few. A potential NASA shift away from Program support to technology development may provide an opportunity to develop the tools needed to ensure the safety of these modern technologies.

Recommendation

NASA should develop a process to ensure that technical safety tool development is identified as a priority when technology development opportunities are being evaluated for future funding.

ASAP Rationale

As the approach of NASA changes to develop the technologies to take us to Mars and further beyond, technical safety tool development is just as important as the new engines and the new computers that will be needed. This also presents an opportunity to use NASA's talented personnel to solve tomorrow's problems. Tool development will open up the trade space even further and provide NASA the ability to understand and control the risks of state-of-the-art technologies it will be using.

NASA Response

NASA concurs that the potential refocus of NASA on technology development presents the Agency with the opportunity for increasing the priority of developing and promulgating advanced safety and risk analysis techniques and associated tools in support of NASA missions, as well as research and commercial technology transfer programs. The Office of Safety and Mission Assurance (OSMA) has annual proposal calls for research to develop new safety analysis tools and techniques. OSMA also has a longstanding research program known as Software Assurance Research Program.¹

In recent years, NASA has made significant advances in developing and applying modern techniques for safety analysis, risk analysis, and risk management. These advances are reflected both in the status of NASA requirements and procedures and in the state of practice of safety and risk analysis within relatively new NASA projects. Significant achievements are:

¹ <http://www.nasa.gov/centers/ivv/research/osmasarp.html>

- The Probabilistic Risk Assessment (PRA) Procedures Guide ² and the related requirements contained in NPR 8000.4, NPR 8715.3, and NPR 8705.5. Particularly in the human spaceflight programs, the adoption of methods and techniques, such as the ones in the PRA procedures guide, has led to the use of quantitative safety metrics, such as the probability of loss of crew, derived from integrated safety and risk analysis models to support safety decision-making. These techniques include event sequence diagrams, event trees, fault trees, uncertainty propagation, parameter estimation, human reliability analysis, software reliability analysis, dependent failure analysis, and phenomenological failure analysis.
- The recently released procedures guide titled “Bayesian Inference for NASA Probabilistic Risk and Reliability Analysis, NASA/SP-2009-569”³ provides technical procedures for generating parameter estimates (e.g., failure rates) used in quantitative safety and risk models.
- The new technical procedures guide titled “NASA Risk-informed Decision Making Handbook” provides guidance for informing decision making through better use of modern risk analysis techniques in selecting alternatives (e.g., design decisions) and in developing credible probabilistic requirements. (This document has been completed and is being prepared for publication.)
- A methodology referred to as “Context-based Software Risk Model” (CSRМ) has been developed to assess the contribution of software and software-intensive digital systems to overall system risk, in a manner which is compatible and integrated with the NASA PRA models.
- The new draft technical procedures guide on “Precursor Analysis Applied to Space Systems” provides guidance for evaluating risk significance of observed anomalies. Precursor analysis has been applied to the Space Shuttle program and is being evaluated for use by the International Space Station program.
- Physics-based simulations were developed and applied by the Constellation Program to evaluate abort scenarios. This effort was briefed at the 2010 First Quarterly Meeting of ASAP (See Recommendation 2010-01-07).
- The S&MA Technical Fellows and Technical Excellence programs were established to develop and institutionalize advanced tools, techniques, and processes.
- NASA-STD-7009, Standard for Models and Simulations. The standard covers the development and operation (or execution) of models and simulations as well as the analysis and presentation of the results.

²<http://www.nasa.gov/centers/ivv/research/osmasarp.html>

³<http://www.hq.nasa.gov/office/codeq/doctree/praguide.pdf>

As for the recommendation that technical safety tool development be recognized as a priority for future technology development opportunities, NASA has already addressed the intent of that recommendation. One of the duties of the S&MA Technical Fellow is to periodically provide the “State-of-Discipline” assessments to NASA senior officials and provide recommendations for the enhancement of discipline practices and related tool development needs. Additionally, on March 24, 2010, the Chief, Safety and Mission Assurance, established the OSMA Research and Technology (R&T) Strategy Team to recommend to NASA how safety and mission assurance functions should be conducted in an R&T development environment in order to promote safety and reliability and to risk-inform technology development decisions.⁴ The NASA Technical Fellows are key members of the R&T Strategy Team whose charter explicitly identifies the following duties:

- Identify strategies for a better support of simulations and model development.
- Identify possible opportunity areas for future Safety, Reliability, and Quality Assurance (SR&QA) research tools development and process improvement.

The “State-of-Discipline” findings and recommendations and the results of the R&T Strategy Team activity will influence OSMA’s annual proposal calls and budget decisions and will also be used to identify opportunities to compete for funding out of the new Space Technology funding area.

With the above ongoing initiatives, NASA believes the intent of the recommendation is addressed. The initial set of recommendations by the R&T Strategy Team is expected to be completed by end of September 2010. S&MA Technical Fellows will report their first “State-of-Discipline” assessment by the end of FY 2010.

⁴ <http://www.nasa.gov/centers/ivv/research/osmasarp.html>

Tracking Number 2010-01-02
Safety and Mission Assurance (S&MA) Technical Excellence Program (STEP)

ASAP Finding

NASA has an excellent process--STEP--to improve the knowledge base and professionalism of the S&MA workforce. The ASAP is impressed with the program that went from concept, to actual practice, to having over 700 graduates in STEP level 1 in one year.

ASAP Recommendation

The NASA Safety Center (NSC) should continue to develop the remaining STEP levels (levels 2-4) for S&MA, and the NSC, in the process of doing this development, should take into account the changing nature of the S&MA roles within the new NASA organization; in essence, develop STEP for future roles, not past roles.

ASAP Rationale

NASA needs to develop the current S&MA curriculum for those jobs that will remain. In the new NASA, however, the work of the S&MA professional will change. The STEP process will need to lead this change with timely development of all S&MA personnel that will be affected by this shift in job responsibilities.

NASA Response

STEP is a career-oriented, competency-based, professional development system focused on the six major disciplines that comprise the NASA S&MA workforce at the Agency level. The six disciplines include: System Safety, Quality Engineering, Reliability and Maintainability, Software Assurance, Operational Safety, and Aviation Safety. We have completed the design and development of the (levels 2-4) curriculums for each discipline and identified 2,244 hours of discipline-related training to address the S&MA workforce needs from novice to subject-matter expert. In early March, we received approval from the Chief, Safety and Mission Assurance, to proceed with the execution of the (levels 2-4) elements. This is currently underway. Today, approximately 60 percent of the training required for the entire STEP is available and ready for delivery in a Web-based or instructor-led format. We are finalizing the comprehensive plan to develop the remainder.

STEP uses a four-level progression framework that is structured to meet the demands of safety professionals at each level of their career. Our program has taken a very professional and rigorous approach to adult learning and training development using Bloom's Taxonomy of Learning Domains to define and organize the 266 different safety- and engineering-related competencies within NASA. We use the Instructional System Design model and professionals to develop every course that we utilize in the program.

Additionally, STEP was designed in an extremely modular fashion to address specific competencies and performance objectives for each discipline. As the Agency gains a clearer vision for the future and more definition regarding the programmatic changes and

as S&MA roles change within the new NASA organization, NSC will perform competency-based assessments and individual job analyses for these new safety functions. This information can then be analyzed and compared to the existing workforce and performance requirements so that appropriate changes can be made to fill any competency gaps. We have configuration-controlled training documentation and Competency-to-Course Comparison Matrixes for each discipline's training program that allow us to assess coverage and traceability of the individual competencies to the courses utilized. As a result of this, we will be able to perform a very detailed assessment of the competency make up of an individual team, program, organization, and/or Agency functional area, ultimately creating a gap analysis. Using the competency-based analysis, individual courses can be added, removed, or modified to address the new requirements as a result of new or modified Agency direction. Additionally, our program uses the NASA System for Administration, Training, and Educational Resources for the NASA (SATERN) Learning Management System which will make it extremely effective and efficient to make changes to STEP which are instantly apparent and communicated at the Agency level.

Tracking Number 2010-01-03
Safety and Mission Assurance (S&MA) to Analyze Changing Work and Skills
Needed for the Future

ASAP Finding

NASA's work in human spaceflight will be changing with the new FY 2011 budget. S&MA work will also change, and new skills (or a different mix of skills) will be needed.

ASAP Recommendation

NASA S&MA should take a leadership role in beginning to analyze how the S&MA work is going to change, and what kinds of skills are going to be needed in the future.

ASAP Rationale

As the new NASA direction becomes clearer, the S&MA organization should identify the skills, technologies, knowledge, and experiences that will be required of the S&MA professional of the future. One example may be how the S&MA organization will verify that the commercial LEO providers support strong safety.

NASA Response

With NASA's renewed focus on research and technology development, the Agency's S&MA community realizes there needs to be a better way to assist researchers and developers in building safety and reliability into programs and projects from the start. To do that, we need to find better ways to provide quick and accurate risk evaluations to the researchers to support risk-informed designs, and we need to find better ways to ensure the safety of facilities, test rigs, test stands, test cells, testing approaches, and other environments where demonstration prototypes are tested and evaluated. We need to take the best of our Center processes and make them available to those who will be doing technology development work for the first time. To this end, the Office of Safety and Mission Assurance (OSMA) has established a team to evaluate our current capabilities, perform trade studies and gap analyses, and develop a set of recommendations to ensure that NASA maintains safety of its facilities, assets, personnel, and the public while supporting advances in technology. This team will evaluate and provide recommendations for needed additions and/or modifications to procedural, facility, test, and product requirements, as well as oversight and verification capabilities.

As the Agency gains a clearer vision for the future and more definition regarding the programmatic changes, and as S&MA roles change within the new NASA organization, the OSMA will take an active Agency leadership role, working with each Center S&MA Director, their Directorate, and the major programs and projects to define the new safety and mission assurance roles and functions that are required to adequately support the programmatic changes. The NASA Safety Center (NSC) will play a key support role, working with OSMA and each affected Center, to address competency, performance, and training gaps that are identified (see Recommendation 2010-01-02). The ultimate goal will be to maintain a standardized Agency S&MA Professional Development System as well as to be positioned to provide focused training events and seminars addressing

unique one-time and very specialized training needs at the program, project, and functional-area levels. Detailed S&MA assessments will begin no later than the end of FY 2010, and updates will be provided at subsequent ASAP quarterly meetings.

Tracking Number 2010-01-07

Methodology for Performing Integrated Abort Risk Analysis and Development of Supporting Tools

ASAP Finding

Integrated abort risk analysis and assessment are required for the proper design of crew survivability methods. This presents a challenge to launch vehicle providers who need to design for safe human flight and provide evidence of satisfactory accomplishment.

ASAP Recommendation

NASA should prescribe the methodology for performing integrated abort risk analysis and develop the supporting tools as needed so that these types of analyses are performed uniformly across the industry. This guidance could be developed as a stand-alone guidance document and be referenced in the HR criteria.

ASAP Rationale

Properly designed abort triggers, including measurements to provide for abort triggering and the requisite timing of the abort triggers, are needed to ensure the safety of the crew. The ASAP feels that the industry as a whole could benefit from having guidance in this area, and that this in turn will facilitate NASA's insight and oversight activities to validate proper performance of this analyses when applied to NASA-crewed flights.

NASA Response

NASA agrees with the intent of the recommendation which is to develop technical guidance for performing abort risk analysis as part of an integrated mission risk analysis. This analysis of abort effectiveness demands consideration of the complex and dynamic interactions among the vehicle systems, potential vehicle failures, human performance, and flight environment. Traditional static risk modeling techniques are suboptimal for this type of analysis, and the use of physics-based techniques capable of modeling the complex dynamics is needed.

As part of our continued improvement of technical procedures and processes, NASA has begun to update the Probabilistic Risk Assessment (PRA) Procedures Guide. Several new chapters are being developed to introduce advanced techniques, including physics-based modeling and simulations, into the risk modeling process. NASA will expand the ongoing updating activity to include procedures for the modeling and simulation of abort scenarios using the Ares experience as an example. The new revision to the PRA Procedures Guide will be completed in the spring of 2011. The PRA Procedures Guide, with these new additions, will serve as a guide for in-house and commercial efforts. These new chapters can be referenced in NPR 8705.2 and other documents such as the Human-Rating Guidance Document currently under development. Once developed, NASA will communicate this guidance to commercial launch vehicle providers in a manner that is consistent with the NASA acquisition approach.

Tracking Number 2010-01-08
Leading Indicators for Industrial Safety

ASAP Finding

Marshall Space Flight Center (MSFC) has an exceptionally strong industrial safety program and the Safety and Mission Assurance (S&MA) organization is to be commended for their efforts to achieve even better results. One area worth further investigation is improving on the set of leading indicators that are used to gauge the potential for mishap occurrence.

ASAP Recommendation

The MSFC S&MA organization should spend some time looking at leading indicators that other industries and organizations are using. In particular, the chemical process industry is a source that may be helpful.

NASA Interim Response

MSFC is taking a three-part approach to working the recommendation: 1) collaborating with other NASA Centers by sharing this finding and current MSFC leading indicators and requesting that other Centers share their practices and recommendations regarding leading indicators; 2) researching industry sources, including the chemical process industry, for best practices; and 3) contracting with a safety program expert to obtain a review of MSFC leading indicators and current metrics. Findings and recommendations will be shared with other Centers through quarterly S&MA Director's Meetings and submitted to the Center's Integrated Management Review Council for adoption at MSFC. Estimated completion timeframe is September 2010.



Mishap Investigation Process and Metrics

**ASAP Status Meeting
NASA Headquarters
Washington, DC**

April 29, 2010

**Presented By:
Faith Chandler
NASA Headquarters
Office of Safety and Mission Assurance**



Agenda

Mishap Investigation Process Overview and Metrics

- 1) Complete Investigation and Mishap Report
Purpose, Responsible Personnel, and Process Metrics
- 2) Review and Endorse Report
Purpose, Responsible Personnel, and Process Metrics
- 3) Develop Corrective Action Plan
Purpose, Responsible Personnel, and Process Metrics
- 4) Implement Corrective Action Plan
Purpose, Responsible Personnel, and Process Metrics
- 5) Verify Corrective Actions Complete and Close Plan
Purpose, Responsible Personnel, and Process Metrics

Access to Mishap Report and Lessons Learned

NASA Civil Service Employees

Public – Authorization for Public Release

ASAP Recommendations Related to Mishap Investigation and Status



Mishap Investigation Process Overview

ASAP Comment 2009-03-03 (3rd quarter) Following July Mishap Metrics Presentation

Metrics on MIB Report Authorization and Release from NASA HQ. There is a continuing concern about the tracking and trending of administrative turnaround of reports at NASA HQ - specifically, **the timeliness of getting the final authorization** of the MIB report through the various offices at NASA HQ. The ASAP did not receive any particular metrics or statistics in this area. The Panel recommends that the NASA HQ Mishap Office continue to pull the data in this area together to determine whether the trend is in the right direction. A chart should be presented to the ASAP at the next meeting. A quarterly report on this topic is requested.

ASAP Review of NASA Responses Dated March 15, 2010

Recommendation 2008-02-07, Accident Review Timeliness: The NASA response dated March 15, 2010, to this recommendation indicates that NASA has completed several actions in various areas to revitalize its safety data management system. Improved processes have been instituted for performing root cause and trending analyses and to increase visibility of the statistics to executive management and Agency wide. The NASA response recommends closure on portions of the plan with two actions remaining open for completion this year and the ASAP concurs with this status. What the ASAP finds still lacking in the NASA response is the executive summary that provides overall evidence that **the timeliness of the entire accident investigation process starting with the initial report of the mishap occurrence through to endorsement of the accident investigation board report including development and closeout of the corrective action plan**, has improved.



Agenda

Mishap Investigation Process Overview and Metrics

- 1) Complete Investigation and Mishap Report
Purpose, Responsible Personnel, and Process Metrics
- 2) Review and Endorse Report
Purpose, Responsible Personnel, and Process Metrics
- 3) Develop Corrective Action Plan
Purpose, Responsible Personnel, and Process Metrics
- 4) Implement Corrective Action Plan
Purpose, Responsible Personnel, and Process Metrics
- 5) Verify Corrective Actions Complete and Close Plan
Purpose, Responsible Personnel, and Process Metrics

Access to Mishap Report and Lessons Learned

NASA Civil Service Employees

Public – Authorization for Public Release

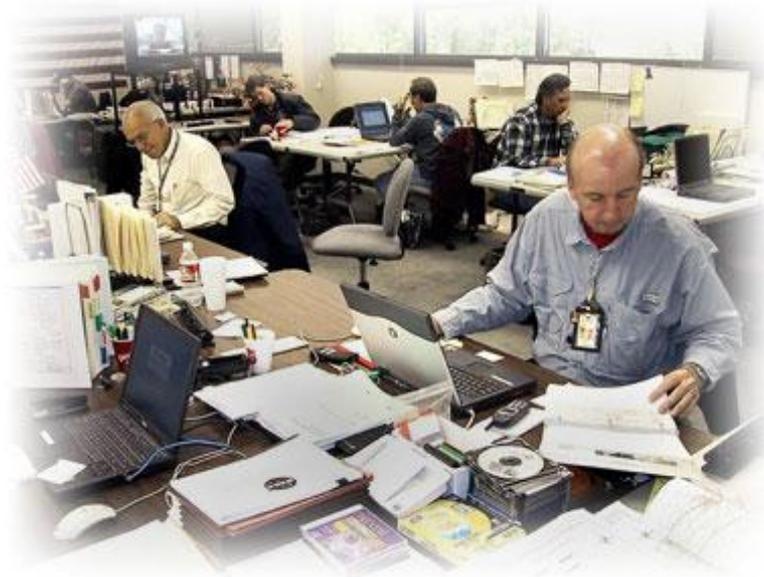
ASAP Recommendations Related to Mishap Investigation and Status



Complete Investigation and Mishap Report

Purpose

- The sole purpose of the NASA mishap investigation process is to prevent recurrence of undesired outcomes.
- This is done by determining the cause and then developing recommendations for preventing recurrence.
- This purpose is completely distinct from any proceedings the Agency may undertake to determine civil, criminal, or administrative culpability or liability.
- A safety investigation does not assess blame.



Responsible Personnel

Appointing official (Center Director or Mission Directorate Associate Administrator)

Investigating authority

Process

- Appointing official selects investigating authority.
- Concurring officials (same as endorsing officials) concur on selection of members on investigating authority.
- Appointing official determines length of time to perform the investigation (**75 workdays or fewer** workdays) and documents that in the appointment letter.
- Investigating authority completes investigation, generates a report, and provides the report to the appointing official.

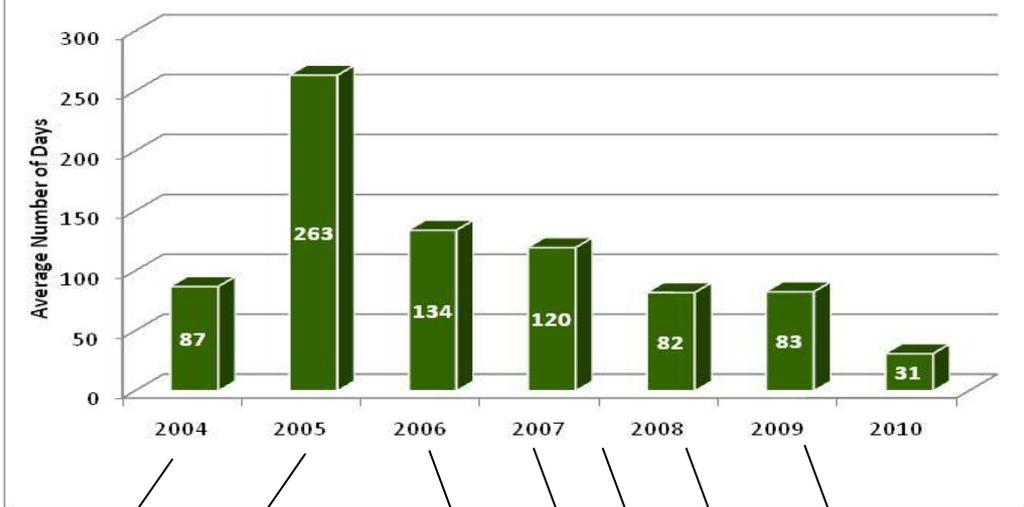


Average Days to Complete Investigation and Mishap Report (Type A, Type B, and High Visibility Mishaps)

Metrics

All investigations completed 2004-2009, 1 completed 2010

Average Days to Complete NASA Conducted Mishap Investigation and Report (Type A, Type B, and High Visibility Mishaps and Close Calls) By Calendar Year: 2004-2010



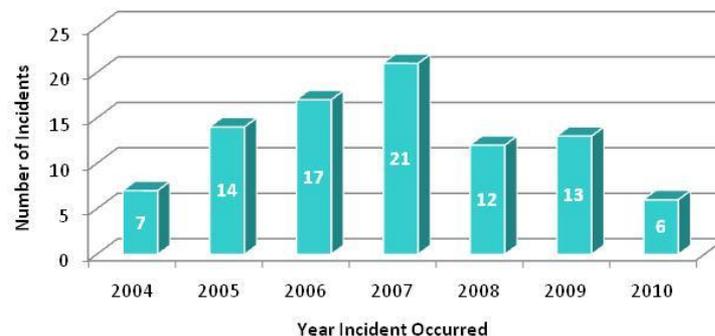
- Feb. 11, 2004: 1st Requirements for mishap investigation. (Previously guidelines)
- 2004: New mishap investigator training required
- 2004: IRIS started
- Jan. 2005: Mishap website started
- Jan 2005: Created list of trained investigators for appointing officials
- 2005: Updated training
- 2006: HQ Mishap Board support provided by OSMA.
- June 2006: Safety alerts started
- Jan. 2007: Updated training
- Oct. 2007: Started NSC Mishap Investigation Support Office
- May 2008: Fully Staffed NSC Mishap Investigation Support Office
- Jan 2009: Root Cause Analysis Tool (RCAT) beta software released
- April 2008: Appointing official checklist developed and distributed
- Oct. 2009: Complete RCAT software released

NASA has made significant progress in completing NASA mishap investigations in a more timely manner.

This improvement is due to a number of factors including the following:

- 1) New detailed requirements for trained investigators.
- 2) New training for management and investigators.
- 3) Specific instructions to investigators in the appointment letter.
- 4) Instructions and checklists developed for appointing officials.
- 5) Additional oversight and support of Type A and Type B Mishap Investigation Boards (MIBs) by OSMA.
- 6) New software to support analysis and process.

Number of Type A, Type B, and High-Visibility Mishaps and Close Calls By Calendar Year: 2004-2010





Agenda

Mishap Investigation Process Overview and Metrics

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Purpose, Responsible Personnel, and Process Metrics
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- 5) Verify Corrective Actions Complete and Close Plan
Purpose, Responsible Personnel, and Process Metrics

Access to Mishap Report and Lessons Learned

NASA Civil Service Employees

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ASAP Recommendations Related to Mishap Investigation and Status



Review and Endorse Mishap Report

Purpose :

- Allows appointing official and senior officials at NASA Headquarters and the Centers to review a mishap report, concur or non-concur on the investigation findings, concur or non-concur on recommendations, and determine if the investigation report is accepted or rejected.

Responsible Personnel – Endorsing Officials (List is for Type A, Type B, and High Visibility Incidents):

- Appointing official (Center Director or Mission Directorate Associate Administrator) (required)
- Chief, Safety and Mission Assurance (required)
- Chief Engineer (required – since 2006)
- Chief Health and Medical Officer (required only when injuries occur)
- Aircraft Management Division (required only when incident involves aircraft)
- Others

For all Type A mishaps, Type B mishaps, and high visibility incidents, at least 3 endorsements are required. A report is not officially “endorsed” until all required endorsing officials have completed their endorsement.

Process (Defined in Program/Center Mishap Preparedness Plan as Required by NPR 8621.1):

Appointing official receives report from investigating authority.

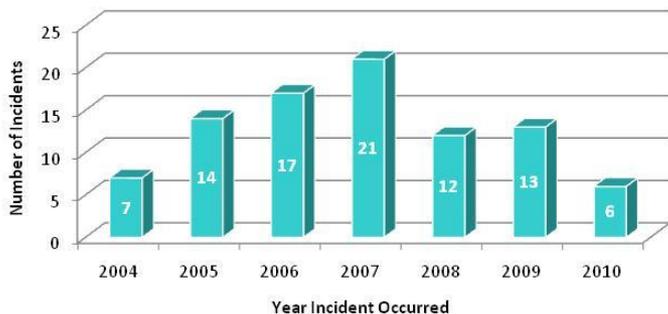
Appointing official sends report to endorsing officials.

Endorsing officials send endorsements to appointing official (and CC others).

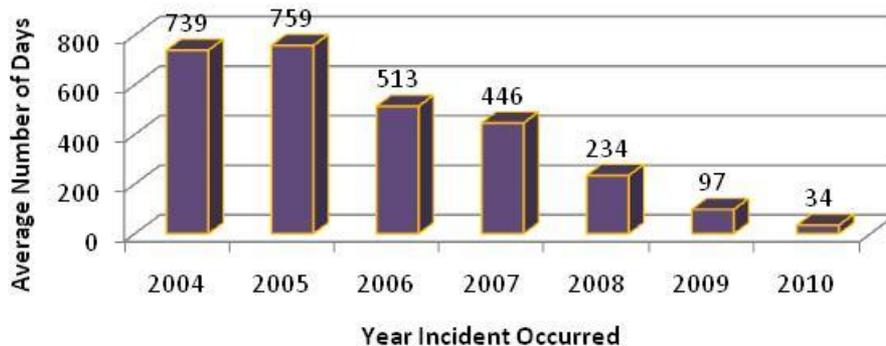


Review and Endorse Mishap Report

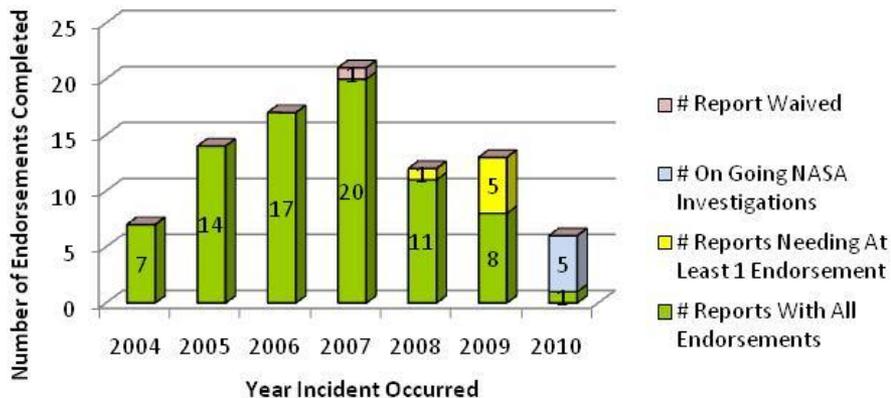
Number of Type A, Type B, and High-Visibility Mishaps and Close Calls
By Calendar Year: 2004-2010



Average Days To Complete All Endorsements
(From Signed Report to Date Last Endorsement Signed)
Type A, Type B, High Visibility Mishaps and Close Calls
By Calendar Year: 2004-2010



Endorsements Completed
(Type A, Type B, and High Visibility Mishaps and Close Calls)
By Calendar Year: 2004-2010



Metrics (Above): **AVERAGE OF WHOLE PROCESS** – Includes time to get report to endorsing officials and endorsement to be completed.

Time to complete endorsements has decreased significantly. Averages high in earlier years due to backlog cases that were not endorsed until 2009-2010.

Backlog completed.

Notes for chart to left:

2007: 1 Report Waived – Contractor injured last day of contract. Company left site and investigation could not be conducted.
 2008: Hy-BoLT / Soarex payload on contractor launch system. Contractor investigation - report received recently. Waiting for AO official endorsement/acceptance.
 2009: 5 NASA investigations completed recently.



Review and Endorse Mishap Report

Reasons for Backlog

Increasing Number of Reports

- Since 2004, there has been an increasing number of mishaps reported.

Lack of Processes

- An appointing official should have a process described in his/her mishap preparedness and contingency plan that identifies who performs all functions related to mishap investigation, including drafting letters to endorsing officials and providing all endorsing officials with signed reports.
- A majority of plans do not include this information. **Reports were not being sent to endorsing officials** by appointing official designees.

Lack of Communication

- Some appointing officials appointed an MIB and then left their position due to normal Senior Executive Service (SES) rotation. The new appointing official did not realize that he/she was responsible for the report completion through the endorsement and corrective action process.

Incomplete Tracking

- Some appointing officials' designees did not track reports to verify that the endorsement process was initialized and, if started, that all endorsements had been received.
- Some appointing officials' **designees only tracked one endorsing official and forgot to notify and track the other required endorsing officials**. Other endorsing officials did not know endorsements were needed.

Staffing

- Endorsing officials received large numbers of reports to endorse and did not have the staff assigned to endorse them. The backlog increased as the number of mishaps increased.
- Due to limited staffing, rigor did not exist in previous years to enforce the endorsement process.

Addition of Endorsing Officials

- In 2006, OCE was added to the process. This was to ensure that all technical authorities were receiving and reviewing major mishap investigation reports. When OCE was added, some appointing official processes were not updated to reflect this.



Review and Endorse Mishap Report

Where Are We Now

- Backlog is complete.
- Process improvements have taken place (and others are in work).
- Endorsements are being completed more quickly.



Agenda

Mishap Investigation Process Overview and Metrics

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Purpose, Responsible Personnel, and Process Metrics

Access to Mishap Report and Lessons Learned

NASA Civil Service Employees

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ASAP Recommendations Related to Mishap Investigation and Status



Develop Corrective Action Plan (CAP)

Purpose and Overview:

- The CAP:
 - Provides a description of the corrective actions along with a designation of the organization(s) responsible for implementing the corrective actions and a completion date for each corrective action.
 - Integrates recommendations from the report and all feedback from the endorsements into one integrated record for tracking what recommendations have been approved, not approved, and added.
 - Allows program/Center to assign actionee and set a schedule that takes into account risk, programmatic/Center milestones, staff resources, and budget.

Responsible Personnel:

- Appointing official (Center Director or Mission Directorate Associate Administrator)
- Responsible organization(s)

Process:

Appointing official directs responsible organization(s) to develop CAP

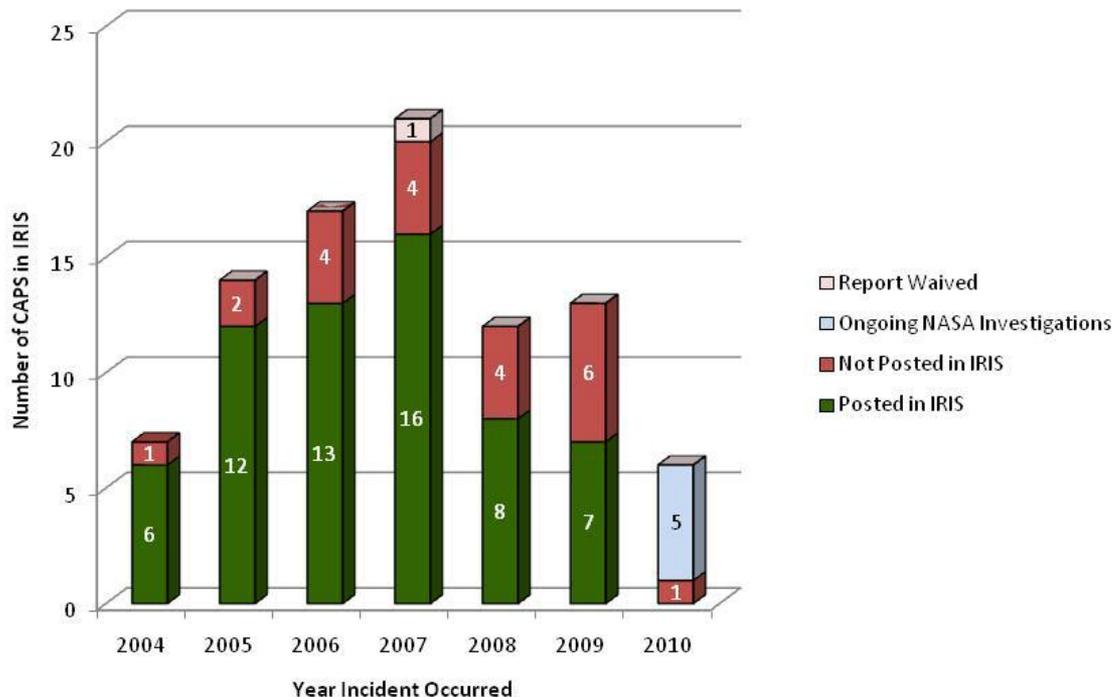
Responsible organization(s) places completed CAP in IRIS



Develop Corrective Action Plan (CAP)

Corrective action plans in IRIS and other tracking **systems do not capture the date** when the responsible organization(s) was tasked to develop the CAP. Without formal record of the start time, we were unable to determine how long it takes to develop the CAP or provide metrics on timeliness of this process.

Number of Corrective Action Plans (CAPS) in IRIS
(Type A, Type B, and High Visibility Mishaps and Close Calls)
By Calendar Year: 2004-2010



Metrics (Based on IRIS data)

62 of 84 (74%) Completed investigations have CAPs in IRIS.

Other IRIS fields have documented implementation of individual corrective actions.

From page 18 of this briefing: 79% (66 of 84) completed investigations with some or all corrective actions done.

* At least 4 CAPS are done and not in IRIS.



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Purpose, Responsible Personnel, and Process Metrics

Access to Mishap Report and Lessons Learned

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ASAP Recommendations Related to Mishap Investigation and Status



Implement Corrective Action Plan (CAP)

Purpose and Overview:

- Complete all recommendations that were approved.

Responsible Personnel:

- Appointing official (Center Director or Mission Directorate Associate Administrator)
- Responsible organization(s)

Process:

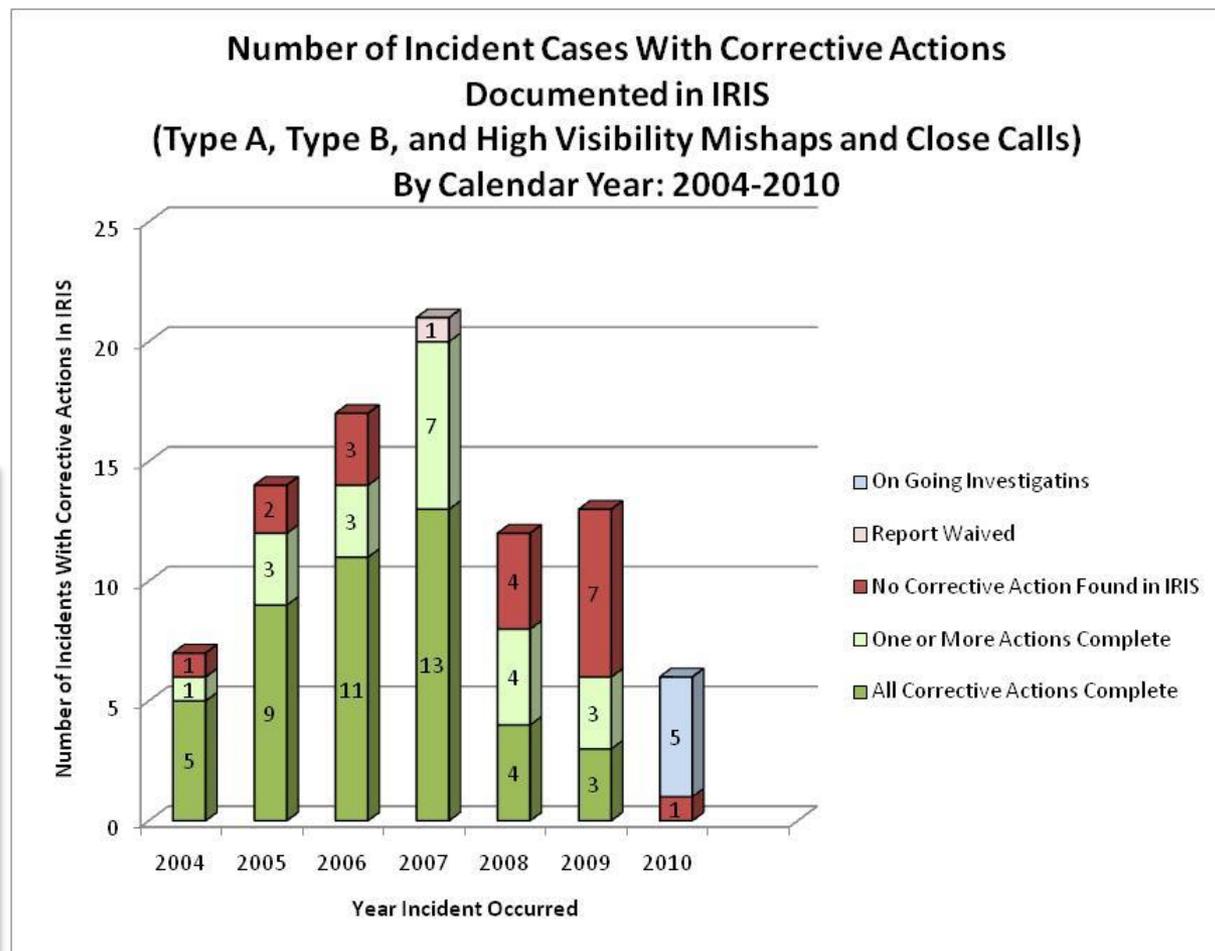
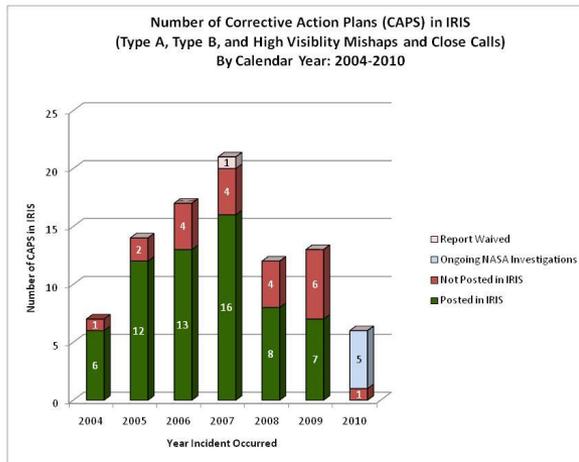
Appointing official directs responsible organization(s) to complete corrective actions.

Responsible organization(s) provides status (at intervals) to the appointing official.

Responsible organization(s) tracks completion of corrective actions in IRIS.



Implement Corrective Action Plan (CAP)



Metrics

54% (45 of 84) All corrective actions complete.

25% (21 of 84) Some actions complete.

79% (66 of 84) Completed investigations with some or all corrective actions done.



Agenda

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Purpose, Responsible Personnel, and Process Metrics

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ASAP Recommendations Related to Mishap Investigation and Status



Verify Implementation of Corrective Action Plan

Purpose and Overview:

- Ensures that the corrective actions are completed and that completion is documented.

Responsible Personnel:

- Appointing official (Center Director or Mission Directorate Associate Administrator)
- Center Safety Office (Designated by appointing official in Mishap Preparedness and Contingency Plan)

Process:

Designated Center Safety Office:

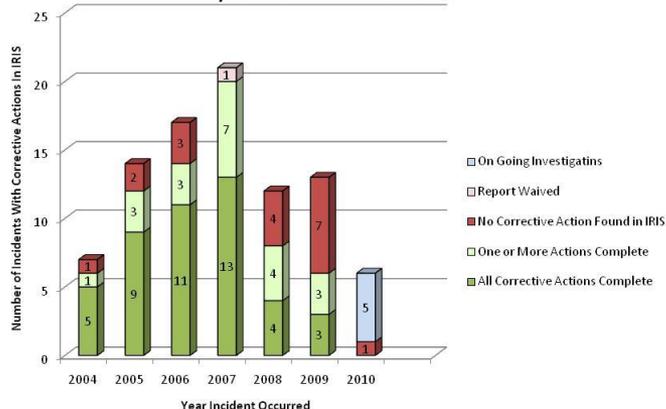
- Monitors corrective action activities to determine if they were carried out per the plan.
- Reports non-compliance to appointing official.
- Verifies that the CAP is complete and correctly recorded in IRIS.

Appointing official develops a CAP closure statement documenting corrective actions are complete and the CAP is closed.



Verify Implementation of Corrective Action Plan

Number of Incident Cases With Corrective Actions Documented in IRIS
(Type A, Type B, and High Visibility Mishaps and Close Calls)
By Calendar Year: 2004-2010



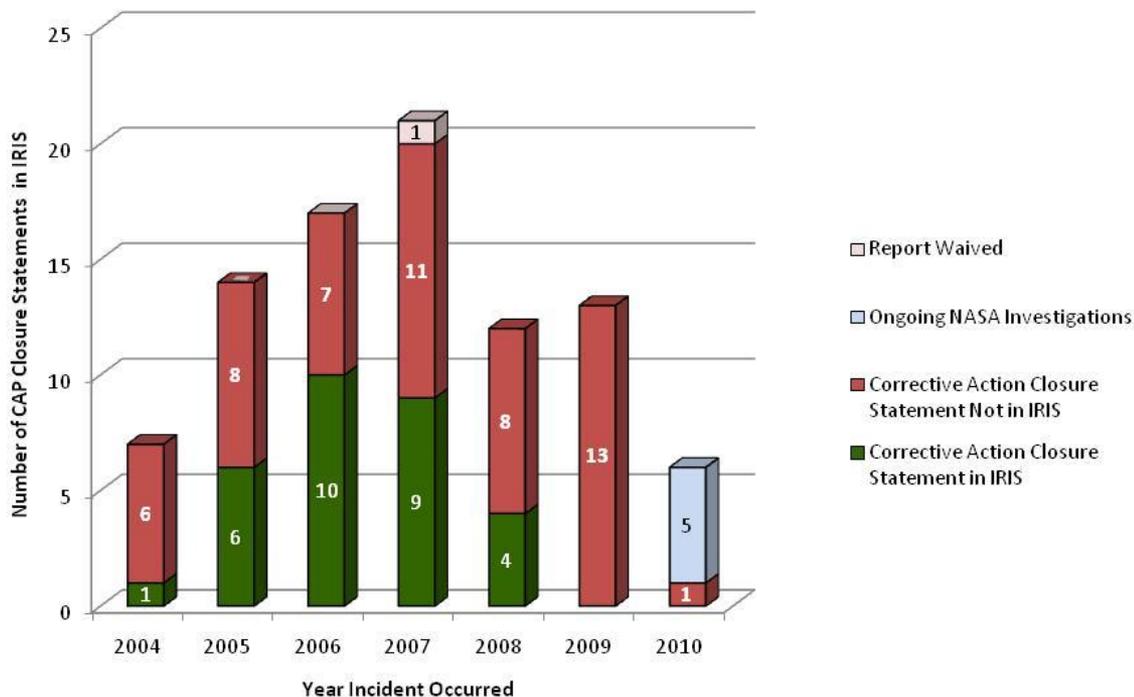
36% (30 of 84) cases have a CAP closure statement.

54% (45 of 84) have all corrective actions complete.

15 CAP closure statements should be in IRIS.

Results indicate corrective actions are being implemented but a CAP closure statement is not being attached to IRIS.

Number of Formal Corrective Action Closure Statements Attached in IRIS
(Type A, Type B, and High Visibility Mishaps and Close Calls)
By Calendar Year: 2004-2010





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Purpose, Responsible Personnel, and Process Metrics

Access to Mishap Report and Lessons Learned

NASA Civil Service Employees

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ASAP Recommendations Related to Mishap Investigation and Status



Access to Mishap Report and Lessons Learned By NASA Civil Service Employees

Civil Service Employees have access to reports in IRIS.

- As new information related to a mishap becomes available, it is attached to IRIS (including signed mishap report).

- A mishap report in IRIS is initially marked NASA Sensitive But Unclassified (SBU) Information. This is because the majority of reports contain:
 - Pre-decision investigative material (pre-decisional until officially endorsed),
 - Personnel information subject to the privacy act,
 - Export Administration Regulation (EAR) information,
 - International Traffic in Arms Regulations (ITAR) information, and/or
 - Other SBU Information.

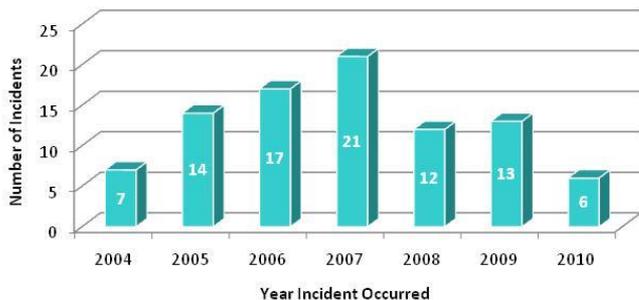
- All NASA SBU information is available to civil service employees in accordance with NPR 1600.1: NASA Security Program Procedural Requirements.

- Consequently, any NASA civil service employee can request a copy of the NASA mishap investigation report from their Center IRIS representative.

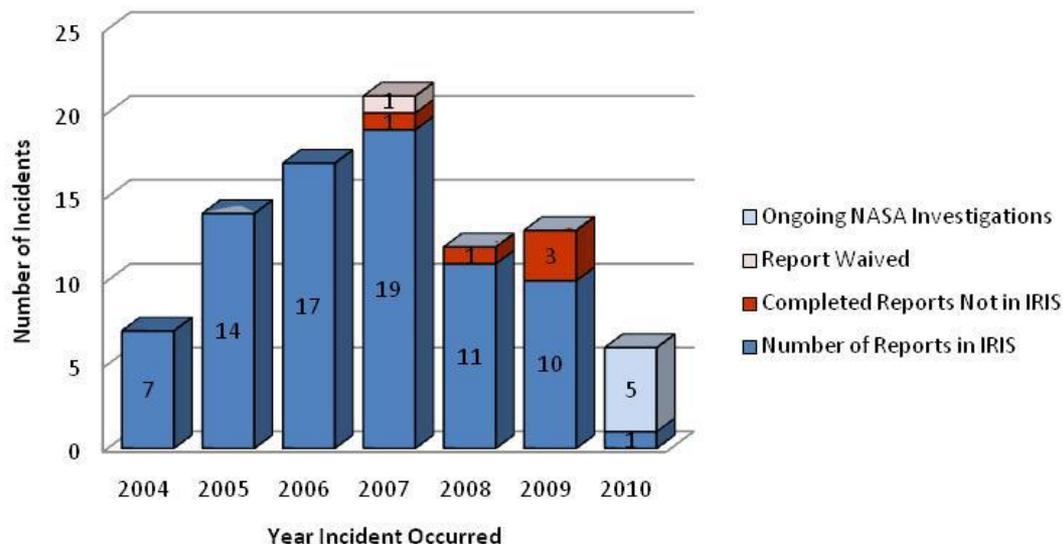


Access to Mishap Report and Lessons Learned By The NASA Civil Service Employees

Number of Type A, Type B, and High-Visibility Mishaps and Close Calls
By Calendar Year: 2004-2010



Number of Reports in IRIS
(Type A, Type B, and High Visibility Mishaps and Close Calls)
By Calendar Year: 2004-2010



Total Incidents 2004-2010 = 90
84 mishap investigations completed.
(5 under investigation, 1 waived)

94% (79/84) Completed reports in IRIS
6% (5/84) Not in IRIS

(IRIS tracks date of last data entry/attachment. This does not allow determination of when the report was placed in IRIS.)

** Some reports are not in IRIS due to 3rd party proprietary data, others are not posted yet. Civil servants can still access the reports by calling the Center SMA office, NSC, or HQ OSMA.*



Access to Mishap Report and Lessons Learned By The Public

Authorization for Public Release

- This process implements the requirements established NPR 1600.1: NASA Security Program Procedural Requirements and ensures that a mishap report is reviewed to determine if it is appropriate for release to the public.
- A mishap report in IRIS is initially marked NASA Sensitive But Unclassified (SBU) Information. This is because the majority of reports contain:
 - Pre-decision investigative material (pre-decisional until officially endorsed),
 - Personnel information subject to the privacy act,
 - Export Administration Regulation (EAR) information,
 - International Traffic in Arms Regulations (ITAR) information, and/or
 - Other SBU Information.
- Many mishap reports investigate injuries of contractor personnel or damage to space flight hardware. Consequently they contain proprietary information or regulated information.
- Other Agencies and industries DO NOT release their full safety investigation reports to the public for these reasons.
- In the past few years (2004-2009), **NASA has released 15 of 84 Type A/B mishap reports (18%) to the public** (Total 21 reports on websites counting reports written before 2004).



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Access to Mishap Report and Lessons Learned

NASA Civil Service Employees

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ASAP Recommendations Related to Mishap Investigation and Status



ASAP Open Recommendations Related to Mishaps and NASA Status

2009-03-03

2008-02-07

2008-01-06



Recommend Closure of Open Actions

Recommend Closure:

2009-03-03 (3rd quarter): ASAP Comment to NASA Following July Mishap Metrics Presentation

Metrics on MIB Report Authorization and Release from NASA HQ. There is a continuing concern about the tracking and trending of administrative turnaround of reports at NASA HQ - specifically, **the timeliness of getting the final authorization** of the MIB report through the various offices at NASA HQ. The ASAP did not receive any particular metrics or statistics in this area. The Panel recommends that the NASA HQ Mishap Office continue to pull the data in this area together to determine whether the trend is in the right direction. A chart should be presented to the ASAP at the next meeting. A quarterly report on this topic is requested.

NASA's Response:

This briefing provides the requested metrics that cover all parts of the mishap investigation process and demonstrate a significant improvement in the timeliness of the investigation process. NASA has made significant process improvements and reduced the time it takes to conduct mishap investigations and to endorse mishap reports. NASA is continuing to strengthen the mishap investigation process and ensure quality reports are generated, effective recommendations are implemented to prevent future mishaps, and lessons are communicated throughout the Agency. Given the small number of Type A and B mishaps each year, NASA will provide ASAP with an annual metrics report, similar to this presentation, each year.



Recommend Closure of Open Actions

Recommend Closure:

2008-02-07: ASAP Review of NASA Responses Dated March 15, 2010

Recommendation 2008-02-07, Accident Review Timeliness: The NASA response dated March 15, 2010, to this recommendation indicates that NASA has completed several actions in various areas to revitalize its safety data management system. Improved processes have been instituted for performing root cause and trending analyses and to increase visibility of the statistics to executive management and Agency wide. The NASA response recommends closure on portions of the plan with two actions remaining open for completion this year and the ASAP concurs with this status. What the ASAP finds still lacking in the NASA response is the executive summary that provides overall evidence that **the timeliness of the entire accident investigation process starting with the initial report of the mishap occurrence through to endorsement of the accident investigation board report including development and closeout of the corrective action plan, has improved.**

NASA's Response:

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Recommend Closure of Open Actions

Recommend Closure:

New ASAP Recommendation in ASAP Response Dated March 15, 2010

With regard to Recommendation 2008-02-07 concerning the process for investigating mission and test failures, NASA provided an excellent summary of the guidelines used in identifying and reacting to mission and test anomalies. In that discussion, **two examples of “natural phenomena” were cited as not being considered mishaps to be investigated and learned from.** The first was the ISS being struck by an unspecified size meteor. The second was NASA property damage resulting from weather such as lightning, high winds, snow loads, flood and wildfire. While all of the conditions highlighted can sometimes be of such magnitude that they exceed established design limits and would legitimately qualify for a “natural phenomenon” exemption, it would appear that a blanket exemption for any natural phenomenon related damage would miss those cases where proper design or administrative procedures should have been capable of protecting the assets, but failed to do so. Examples include damage allowed by defective lightning protection systems, flood damage caused by failure to maintain dikes in flood prone areas, structural building failure when exposed to predictable snow loads, trailers blown over by strong winds because they were not properly secured, and loss of the ISS from a MMOD impact of a type and trajectory that should have been recoverable. **The ASAP recommends that the “natural phenomenon” exemption be clarified to only apply to those events that exceed the intended capabilities of the applicable protective systems and procedures.**

NASA’s Response: NASA conducts many types of safety evaluations outside the mishap investigation process. Natural phenomena are not considered mishaps and not evaluated using the formal mishap investigation process. However, consequences from natural phenomena such as lightning damage are evaluated using other safety processes and result in actions and shared lessons as appropriate. NASA will continue to evaluate damage from natural phenomena such as hurricanes, MMOD, etc., using existing methods, rather than by using the mishap investigation process.



Recommend Closure of Open Actions

2008-01-06: ASAP Updated Recommendation

- The NASA response adequately addresses the ASAP concern by specifying timelines that will ensure more timely reporting of mishap investigation results. Although the NASA response did not explicitly address the ASAP recommendation about appropriate experts to determine root causes, the Panel noted that “trained investigators” would meet a minimum of 45 workdays to successfully identify root causes for Type A and Type B mishaps, thus suggesting that the mishap investigation boards must include personnel with the necessary expertise.
- Because a projected completion date of June 2009 is given for NASA actions, the ASAP requests that NASA conduct a follow-up briefing at the ASAP third quarterly meeting at JPL to update the status of the project and to present metrics on meeting these new deadlines, including a review of the Incident Reporting Information System and NASA Safety Center Web sites, which ASAP members cannot access. NASA should clarify Action 2e, “all mishap reports will be posted within two workdays of their completion,” to indicate whether completion refers to investigation board activity or to release of the mishap report after receipt of NASA Headquarters endorsement.



ASAP Recommendation Update - 2008-01-06

2008-01-06: Recommend Closure With Status Below

- **NASA provided the requested briefing** at JPL in July 2009.
- **NASA conducted the requested evaluation of the NPR 8621.1 requirement** that states a mishap investigation board has 75 workdays to complete their investigation to determine if the duration could be reduced to 30 workdays while still determining root cause. In addition, in 2009, NASA conducted a review of NASA historical documents, performed an evaluation of performance of mishap investigations over the last 5 years, and collected input from the Centers through the Mishap Investigation Working Group.
- After evaluation and input from all Centers and the NASA Safety Center (NSC), NASA concluded that the majority of investigations for Type C mishaps, Type D mishaps, and close calls can be completed successfully and shared with management within 30 workdays.
- **Due to the complexity and scope of Type A and Type B mishaps, Agency Safety and Mission Assurance personnel determined that a minimum of 30 or 45 workdays was an insufficient amount of time to complete a root cause analysis, gather evidence for all root causes, and document all the findings and recommendations in a formal mishap investigation report.**
- Centers were concerned about introducing a significant modification of the requirement for investigating Type A and Type B mishaps. Simple mishaps (e.g., single person ladder fall) can be completed quickly. However, complex mishaps (e.g., rocket failure, satellite failure, complete building fire) require extensive analysis and testing which takes time. Larger cases require time to document all evidence in a detailed report.



ASAP Recommendation Update - 2008-01-06

2008-01-06: Recommend Closure With Status Below

NASA has initiated an update to NPR 8621.1.

Final changes to the NPR are dependent upon disposition of formal Agency comments and completion of the NODIS-required Agency concurrence process.

- a. For Type C mishap, Type D mishap, and close call reports, NASA has proposed a reduction in the time allotted to complete the mishap report from 75 workdays to 30 workdays.
- b. Based on more detailed study discussed above, NASA will not be changing the requirement for Type A and Type B mishap reports. Appointing officials will be encouraged to conduct simple incident investigations in less than 75 workdays.
- c. For Type A mishaps and Type B mishaps, NASA has proposed a change to the requirement for a 30-work day publicly releasable status report to a 15-work day publicly releasable status report. NASA will also proposed to add an additional requirement for proximate causes to be released in the 45-day status report, if they are available at that time.
- d. NASA proposed that the NSC will post all 15-work day publicly releasable status reports on the NSC website and the Mishap Investigation website.
- e. NASA proposed that within **2-workdays of receipt of the investigating authorities' signed report, the responsible Center safety office shall attach the electronic copy of the report in IRIS.** The NSC will verify that this has been completed. (This precedes the endorsement process and will be available to all civil service employees. The endorsed copy will also be posted upon completion of the endorsement process.)



Backup



What Happens When A Mishap or Close Call Occurs?



First Responders (Paramedics, Fire Fighters, Hazmat, etc.)

- Arrive to the scene to treat injured personnel and ensure both personnel and property are safe.



Interim Response Team (IRT) (First Hours – Until Investigating Authority Arrives)

- Document the scene using photography, video, and debris mapping
- Preserve perishable evidence
- Identify the witnesses and collect written statements
- Implement the chain-of-custody process
- Impounds evidence
- Collect debris
- Advise the supervisor if drug testing should be requested



Investigating Authority

- Receive the evidence collected by the IRT
- Collect additional evidence
- Analyze data, identify causes of mishap
- Generate report describing findings and recommendations



NASA Mishap Investigation Website

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Mishap Investigation – Milestone Overview (2002-2009)

- 2002 (June 4): Formation of NASA Mishap Investigation Working Group (MIWG)
- 2003 (July 1): Standardized Root Cause Analysis (RCA) terms, definitions, and methods
- 2003 (July 1): NASA RCA training initiated
- 2004 (Feb. 11): 1st NPR 8621.1: NASA Procedural Requirements for Mishap Reporting, Investigating and Recordkeeping (Previous versions were guidelines)
- 2004 (Feb. 11): 1st Specific knowledge requirements for trained investigator
- 2004 (Feb. 11): Endorsements started (OCE not endorsing official)
- 2004 Incident Reporting Information System (IRIS) civil service access
- 2005 (Aug): Updated on-line training rolled out (SOLAR)
- 2005 (Jan): Mishap Investigation Website started
- 2005 (Jan): List of trained investigators for appointing officials rolled out
- 2006 (May): NPR 8621.1 updated (OCE now endorsing official)
- 2006 (June): Safety Alerts started (later became Mishap WARs)
- 2007 (Jan): Updated on-line training (SATERN)
- 2007-2008: Updated classroom training (new courses added)
- 2007 (July): NASA Safety Center mishap support management hired
- 2008 (Jan): Root Cause Analysis Tool (RCAT) beta software rolled-out
- 2008 (April): Appointing official checklists distributed
- 2008 (May): NSC mishap staffing completed
- 2008 (June): MIWG peer awards for investigators started
- 2009 (Oct): RCAT final software rolled-out



Mishap Warning-Action-Response

NPR 8621.1:

- 5.8.4 At any time during the investigation, the Investigating authority may recommend to the appointing official that immediate corrective actions be taken to ensure the safety of ongoing operations.
- June 2006, OSMA began distributing mishap “Safety Alerts” to Center Directors and SMA Directors so that these findings and recommendations can be shared Agency-wide.
- December 2007, “Safety Alert” was renamed “Mishap Warning-Action-Response” (Mishap WAR).
- Mishap WARs sent out via e-mail and the NASA Advisory system (advisory tracking number shown in red circle) and posted on NASA Mishap Investigation website and the NASA Safety Center website.

Mishap Warning-Action-Response

MIB Case No: 2007-267-0006	Mishap Title: Building 4400 Substation Arc Flash Injury
NASA Advisory No.: NA-MIBO-2008-02	Date of Warning-Action: 2008-01-17
Mishap Classification: Type B	Dollar Property Loss/Injury Severity: \$465/Second Degree Burns
Date of Mishap: 2007-09-24	Location of Center for Mishap: SSC

Brief Description of Mishap:

A Stennis Space Center contractor received thermal burns to both hands due to an arc flash that occurred when the worker replaced a meter base over a 277/480 volt line with a meter in an enclosure. The worker was not wearing protective gloves. The worker was transported to the Stennis clinic by a co-worker, treated and subsequently transported to a local hospital for further treatment and observation.

Problem Description and Details:

The Mishap Investigation Board (MIB) has identified a potential safety hazard associated with the design of the Millant-manufactured meter panel assemblies (PN 5744-5-231 or meter can PN UC744-5-EL with test switches I#10-0110). The meter base portion of each knife switch connected to the voltage and current input for the meters in panel assemblies remains energized when opened. More importantly, when many of these switches are moved to a partially open position, they can possibly extend beyond the enclosure opening exposing the energized knife switch to the user. Therefore, if anyone attempts to place the cover back on to the enclosure while a switch is in this position, it could cause an electrical short between the switch and the enclosure resulting in an arc flash.

Meter Enclosure

Blank Meter Plug in Meter Socket

Test Block/Knife Switches



Review and Endorse Mishap Report

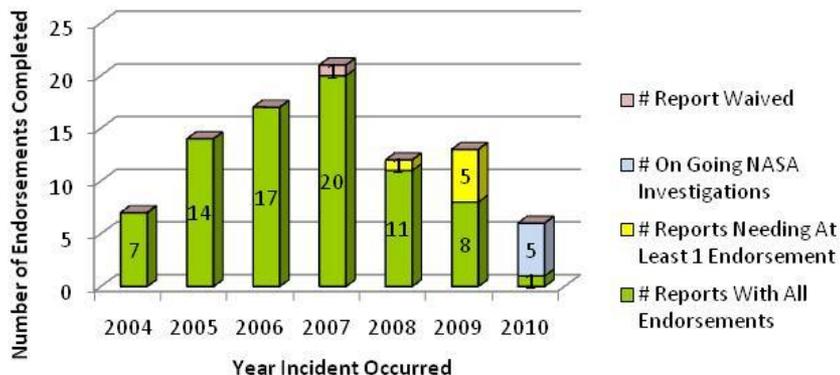
The endorsement process does not

- Impact distribution of the report to the NASA civil service work force. All signed reports are required to go into IRIS. Civil service employees can get reports in IRIS or from the Center IRIS coordinator.
- Impact sharing of lessons learned via the NASA Mishap Warning-Action-Response, Safety Messages, and 30-Day status reports. (These are all cleared for release and distributed as soon as they are completed.)
- Impact implementation of recommendations.

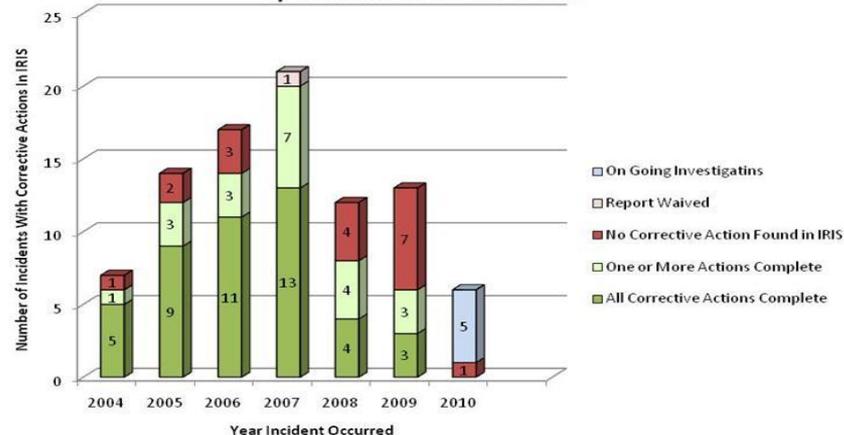
93% Cases Have
All Endorsements Done

79% Cases Have
Some or All Corrective Actions Done
(54% All Done)

Endorsements Completed
(Type A, Type B, and High Visibility Mishaps and Close Calls)
By Calendar Year: 2004-2010



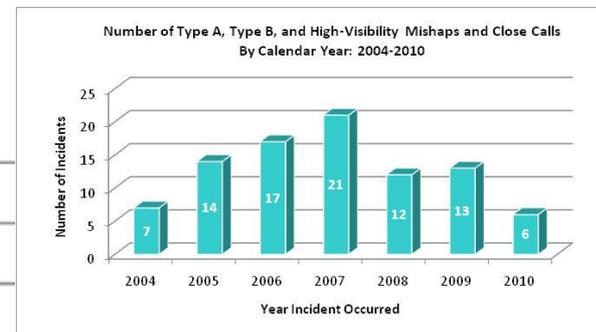
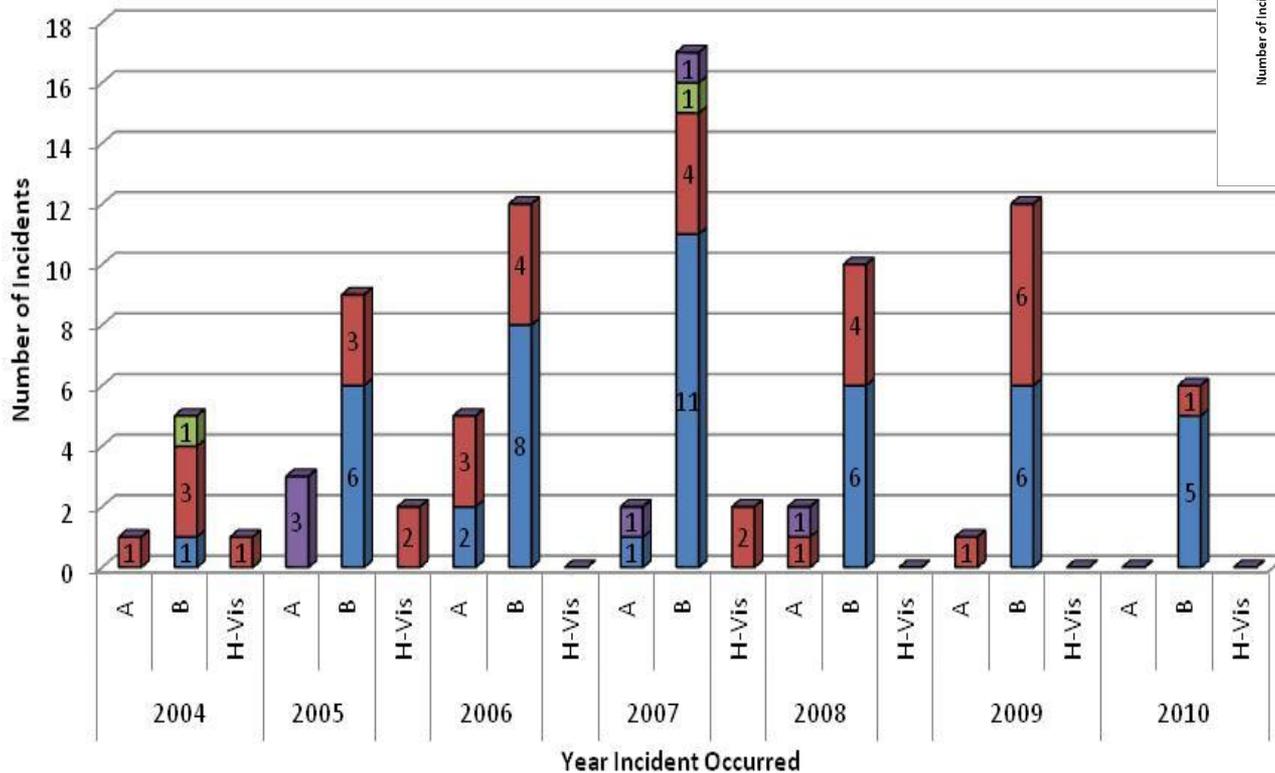
Number of Incident Cases With Corrective Actions
Documented in IRIS
(Type A, Type B, and High Visibility Mishaps and Close Calls)
By Calendar Year: 2004-2010





Additional Detail on Cases in This Presentation

Number of Type A, Type B, and High-Visibility Mishaps and Close Calls
By Calendar Year: 2004-2010
Type Of Consequence



- Mission Failure
- Both Damage & Injury/Illness
- Damage
- Injury/Illness