

National Aeronautics and  
Space Administration



**Office of Inspector General**  
Washington, DC 20546-0001

March 31, 2008

TO: Associate Administrator for Aeronautics Research

FROM: Assistant Inspector General for Auditing

SUBJECT: Final Memorandum on the Review of the National Aviation Operations  
Monitoring Service (Report No. IG-08-014; Assignment No. S-08-004-00)

On October 22, 2007, *The Washington Post* published an Associated Press news article, "NASA Sits on Air Safety Survey,"<sup>1</sup> concerning NASA's denial of a Freedom of Information Act (FOIA) request for the data collected via the National Aviation Operations Monitoring Service (NAOMS). One of the reasons cited for the denial was that the "[r]elease of the requested data, which are sensitive and safety-related, could materially affect the public confidence in, and the commercial welfare of, the air carriers and general aviation companies whose pilots participated in the survey." That statement and the implication that the Federal Government spent taxpayer dollars to gather safety data that NASA was withholding to protect commercial interests prompted a congressional inquiry.

On October 31, 2007, the NASA Administrator appeared before the House Committee on Science and Technology, along with the NAOMS principal investigator; the NAOMS Project survey methodologist; and the Executive Air Safety Chairman of the Air Line Pilots Association, International (ALPA),<sup>2</sup> to answer questions concerning NAOMS and the survey data. Subsequently, the Office of Inspector General (OIG) initiated this review of NAOMS, with the overall objective of reviewing the management of NAOMS. We focused on understanding the history and status of NAOMS, to include its objectives, funding, and plans for using the NAOMS survey data. See Enclosure 1 for details on our scope and methodology.

### ***Executive Summary***

The genesis of NAOMS was rooted in the February 12, 1997, White House Commission on Aviation Safety and Security's "Final Report to President Clinton." For the next

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<sup>1</sup> Rita Beamish, "NASA Sits on Air Safety Survey," *The Washington Post*, October 22, 2007 (accessible as of February 1, 2008, at <http://www.washingtonpost.com/wp-dyn/content/article/2007/10/22/AR2007102200100.html>).

<sup>2</sup> ALPA is the largest airline pilot union in the world and represents 60,000 pilots who fly for 43 U.S. and Canadian airlines.

several years, NASA collaborated with the Federal Aviation Administration (FAA) and the National Transportation Safety Board to examine options and make recommendations concerning potentially useful technologies. Technologies recommended for the identification of existing accident precursors in the aviation system and for forecasting potential safety issues, which NASA developed in parallel and interdependence, became the Aviation System Monitoring and Modeling (ASMM) Project.

The ASMM Project, established in 1999, consisted of four elements: Data Analysis Tools, Intramural Monitoring, Extramural Monitoring, and Modeling and Simulations. The Extramural Monitoring element of ASMM consisted of NAOMS and the Aviation Safety Reporting System (ASRS). Because ASRS is a voluntary reporting system and not suitable for comparative statistical analysis of changes in the safety of the National Aviation System, ASMM Project management designed NAOMS to complement and enhance the ASRS information. NAOMS would include survey data from pilots, mechanics, air traffic controllers, and others, which could provide insights into the performance and safety of the National Aviation System. By routinely evaluating the data, decision makers of the aviation community could quantitatively measure safety, assess trends, identify factors driving those trends, and evaluate the effects of new technologies and procedures introduced into the National Aviation System.

NASA's Ames Research Center contracted with Battelle Memorial Institute (Battelle) to develop NAOMS in fiscal year (FY) 1998 as an additional task under the established ASRS contract. Research and development for a NAOMS survey took place through FY 1999 and into FY 2000. In early 2000, Battelle concluded a field trial of the survey that included 630 responses from air carrier pilots. After Battelle incorporated suggestions and recommendations from aviation community stakeholders, it began the large-scale NAOMS research by implementing the air carrier pilot survey in April 2001. Battelle extended the survey to general aviation pilots the following year. The NAOMS survey was not implemented among any of the other intended survey groups.

Collection of the NAOMS survey data concluded in December 2004. Approximately 30,000 surveys had been completed, consisting of approximately 25,000 air carrier pilot interviews and 5,000 general aviation pilot interviews. Although Battelle and NAOMS Project management had done preliminary analysis of the data, working groups designed to validate the data did not accomplish this goal. As a result, the value of the NAOMS survey data as a potential contributor to the prevention of aviation mishaps has not been determined.

In 2004, NAOMS Project management began work to transition NAOMS to a Web-based application and prepare it for permanent service. The Joint Implementation Data Analysis Team (JIMDAT) of the Commercial Aviation Safety Team (CAST)<sup>3</sup> showed

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<sup>3</sup> The JIMDAT monitors the implementation of aviation safety enhancements and suggests modifications and changes to CAST, whose aim is to reduce the risk of commercial aviation fatalities in the United States. CAST is composed of aviation community and Government representatives.

particular interest in the NAOMS Project for monitoring and measuring safety enhancements introduced into the National Aviation System. Following the successful demonstration of the application, ALPA offered to operate NAOMS on behalf of CAST and accepted NAOMS as a Web-based application for permanent service in January 2007.

Following the October 2007 publication of the Associate Press article, the NASA Administrator appeared before the House Committee on Science and Technology on October 31, 2007. Questions posed by Congress centered on the survey confidentiality and the release of the data. The Administrator's testimony included a promise to release and publish the NAOMS data. On December 31, 2007, the redacted NAOMS survey data were posted on NASA's Web site.<sup>4</sup> Although the Web site contains some previously unreleased information, the Web site does not adequately articulate the purpose of the NAOMS Project and its relationship and contribution to the larger ASMM Project.

We found that NAOMS Project management conducted the research, development, and implementation of NAOMS in accordance with NASA Policy Directive (NPD) 7120.4A, "Program/Project Management," November 14, 1996, and NASA Procedures and Guidelines (NPG) 7120.5A, "NASA Program and Project Management Processes and Requirements," April 3, 1998.<sup>5</sup> However, we found several project management deficiencies that occurred over the life cycle of NAOMS. Specifically,

- NASA contracting officers did not adequately specify project requirements nor hold Battelle responsible for completing the NAOMS Project as designed or proposed;
- the contractor underestimated the level of effort required to design and implement the NAOMS survey;
- NASA had no formal agreement in place for the transfer and permanent service of NAOMS; and
- NAOMS working groups failed to achieve their objectives of validating the survey data and gaining consensus among aviation safety stakeholders about what NAOMS survey data should be released.

Additionally, we found that NASA had not adequately described the designed and intended uses of NAOMS data. Specifically, as of February 2008, NASA had not

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<sup>4</sup> <http://www.nasa.gov/news/reports/NAOMS.html> (updated January 14, 2008; accessed February 4, 2008).

<sup>5</sup> NPD 7120.4A and NPG 7120.5A were the applicable guidelines for the NAOMS Project at its inception in 1998, and we used those documents for our review. The NPG was subsequently replaced by NASA Procedural Requirements (NPR) 7120.5 series, the current iteration of which is NPR 7120.5D, "NASA Space Flight Program and Project Management Requirements," March 6, 2007.

published an analysis of the NAOMS data nor adequately publicized the details of the NAOMS Project and its primary purpose as a contributor to the ASMM Project. Consequently, the NAOMS survey data, which were intended to be just one part of the ASMM Project, could potentially be taken out of context and misunderstood in relation to identifying aviation risk.

The Government may have missed an opportunity to foster a deeper understanding of the aviation safety environment from 2001 through 2004 because its working groups were unable to reach a consensus on the validity or value of the NAOMS data. As a result, NASA was reluctant to publish a report detailing research and conclusions garnered from the collected NAOMS survey data.

Our February 19, 2008, draft of this memorandum recommended that the Associate Administrator for the Aeronautics Research Mission Directorate (ARMD) take the lead concerning NAOMS data and determine whether the data were useful for NAOMS' intended purpose: to produce data from which trends might be identified and considered in concert with other ASMM activities. Additionally, we recommended that the Associate Administrator for ARMD ensure that NAOMS Project research is published and that he make NAOMS-related information available to all interested parties.

In commenting on the draft of this memorandum (see Enclosure 3), the Associate Administrator concurred with our recommendation to determine whether NAOMS accomplished its intended purpose of producing data from which aviation safety trends might be identified, as well as our recommendation to release and post on NASA's public Web site NAOMS-related information. We consider these two recommendations resolved.

The Associate Administrator nonconcurred with our recommendation to publish a detailed report analyzing the NAOMS research, to include findings and conclusions gained from the survey data, preferring to focus resources on better understanding the validity of the survey methodology. Management's planned action is partially responsive to the intent of our recommendation, which was to provide closure for the NAOMS Project. Accepting the Associate Administrator's view that understanding the validity of the NAOMS survey methodology may prove to be the most valuable component of the NAOMS Project, we revised the draft recommendation. Our revised recommendation makes the publication of a detailed report analyzing the NAOMS research contingent upon the results of ARMD's planned independent assessment of the NAOMS methodology. We request that management provide additional comments in response to this revised recommendation by April 30, 2008.

### ***Background***

Following the publication of the White House Commission on Aviation Safety and Security's "Final Report to President Clinton," February 12, 1997, President Clinton announced that NASA had agreed to participate in research and development that would enable the achievement of the accident reduction goals cited in the report. In

collaboration with the FAA and the National Transportation Safety Board, NASA formed the Aviation Safety Investment Strategy Team. The team held a series of workshops, which included active participation from aviation manufacturers and operators and university, industry, and other governmental safety and research laboratories, to examine options and make recommendations concerning potentially useful technologies. Technologies recommended for identifying existing accident precursors in the aviation system and for forecasting potential safety issues, which NASA developed in parallel and interdependence, became the ASMM Project.

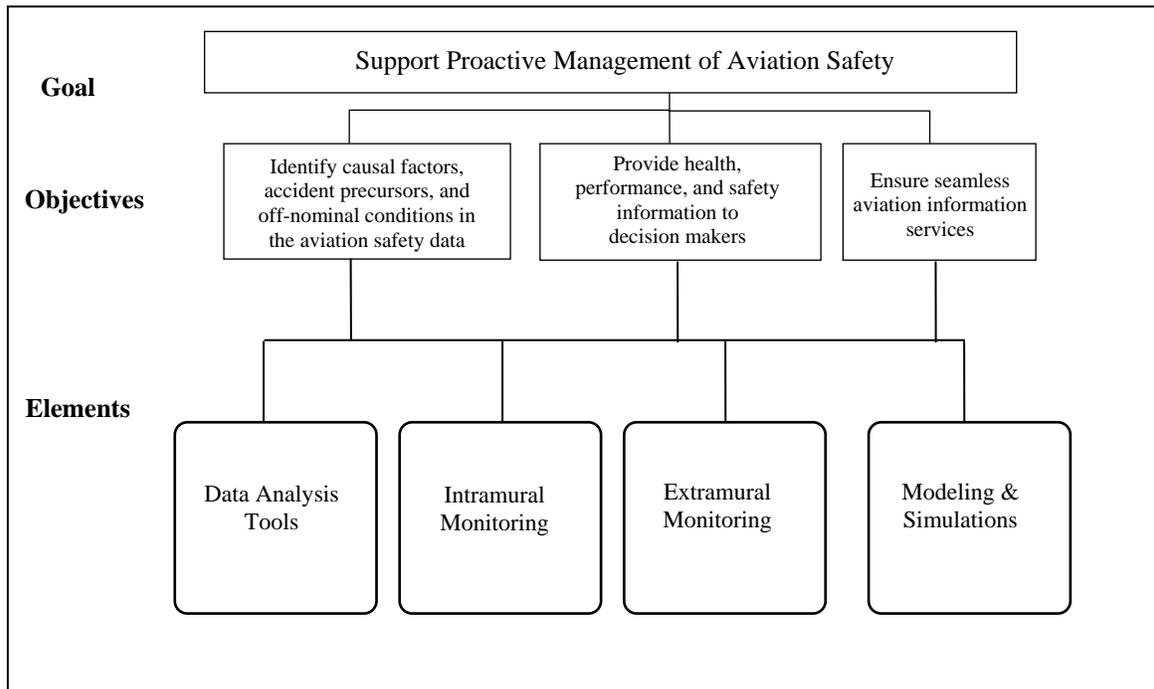
In 1999, the ASMM Project developed into an ambitious research project whose goal was to provide decision makers of the aviation community – air carriers, air traffic management, and other air service providers – with regular, accurate, and insightful measures of the health, performance, and safety of the National Aviation System. The ASMM Project was one of five projects of NASA’s Aviation Safety Program (AvSP) and was primarily concerned with gathering and using data on incidents and normal operations to identify the precursors to accidents. The other four projects aimed primarily at developing solutions to problems identified as causes of accidents.

The ASMM Project consisted of four elements: Data Analysis Tools, Intramural Monitoring, Extramural Monitoring, and Modeling and Simulations.<sup>6</sup> ASMM Project management designed the four elements to be interdependent and interrelated. Each element consisted of at least one product that had some stand-alone capability. However, the intent and value of ASMM was as an integrated suite of tools that would support the goal of proactive management of aviation safety. Figure 1 illustrates how each element was intended to attain that goal.

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<sup>6</sup> For the first 2 years, 1999–2001, ASMM had an element called Information Sharing, and Data Analysis Tools and Intramural Monitoring was one element. During a re-scoping study at the end of FY 2001, the Information Sharing element was eliminated and the Data Analysis Tools and Intramural Monitoring element was separated into individual elements, maintaining the four-element structure of ASMM.

**Figure 1. Aviation System Monitoring and Modeling Project**



Source: September 15, 2000, ASMM Project Plan

The Extramural Monitoring element of ASMM, which provided for upgrading ASRS and improving its capabilities, consisted of NAOMS and ASRS. ASRS was first implemented in April 1976. The ASRS infrastructure was fully modernized in order to process reports more efficiently and allow for the extraction of critical information from the received incident reports. Because ASRS is a voluntary reporting system and not suitable for statistically valid trend analysis, NAOMS was designed to complement and enhance the ASRS information and to provide a source for comparative statistical analysis.

**NAOMS Objectives.** ASMM Project management intended NAOMS to meet the goals and objectives of the Extramural Monitoring element of ASMM by implementing a system of continuous surveys of various groups within the National Aviation System. NAOMS would include survey data from pilots, mechanics, air traffic controllers, and others, collected at regular intervals, to gain insightful measures of the performance and safety of the National Aviation System. By routinely evaluating the data, decision makers within the aviation community could quantitatively measure safety, assess trends, identify factors driving those trends, and evaluate the effects of new technologies and procedures introduced into the National Aviation System.

ASMM Project management expected to incorporate the NAOMS survey data into a comprehensive model that could be used to reduce the aviation accident rate. While providing important information within the Extramural Monitoring element of ASMM, the NAOMS data were never intended to stand alone. The intent was that trends and

findings indicated by the NAOMS survey data would require additional corroboration and investigation.

**Development and Implementation of the NAOMS Project.** ASMM Project management established aggressive goals for the development and implementation of the NAOMS surveys and the associated improvements to ASRS. As described in the FY 1999 Extramural Monitoring Project Plan and the September 15, 2000, ASMM Project Plan (the Project Plans), by the end of FY 2004, concurrent with upgrading ASRS, NAOMS was to have incorporated the surveys of air carrier flight crews, air traffic controllers, cabin crews, mechanics, and general aviation pilots and was to be transferred to an organization external to NASA for permanent service.

NASA's Ames Research Center contracted with Battelle to develop NAOMS in FY 1998 as an additional task under the established ASRS contract. Research and development of the initial survey took place through FY 1999 and into FY 2000. The survey contained four sections. Section A, "Background Questions," related to the surveyed pilots' experiences, such as hours and legs flown, aircraft flown, crew position, etc. Section B, "Safety Related Events," was for benchmark safety events to be tracked over time. Section C was designed as a flexible section to target a specific safety event or new technological or procedural changes. Section D, "Questionnaire Feedback," was for survey respondents' comments.

In early 2000, Battelle concluded a field trial that included 630 responses from air carrier pilots. Battelle used the field trial to determine the feasibility of the concept and presented the results to the FAA and other aviation community stakeholders at a NAOMS Workshop in March 2000. The trial evaluated various modes of administering the survey, including face-to-face, telephone, and mail-in survey, in addition to evaluating recall period, sample size, and cost. The trial determined that interviews via telephone, a recall time period between 4 and 8 weeks, and 8,000 to 9,000 interviews per year sampled from the Airmen Certification Database<sup>7</sup> would provide statistically sound results. Battelle concluded at the end of the trial that the NAOMS survey was a viable method for collecting aviation safety data.

Battelle made changes to the survey based on recommendations from the survey respondents and aviation community stakeholders and began the large-scale NAOMS research by implementing the air carrier pilot survey in April 2001. By December 2002, Battelle had completed nearly 12,000 interviews and preliminary analysis of the data. Battelle also collected and analyzed data from general aviation pilots, which included 500 corporate and 500 rotorcraft pilots, as directed by a congressional earmark. Concurrently, Battelle designed a draft air traffic controller survey.

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<sup>7</sup> The FAA maintains an Airmen Certification Database of pilot names, which Battelle used to obtain its sample.

NAOMS Project management realized by December 2002 that Battelle would not be able to develop and implement surveys for mechanics and cabin crews before the end of FY 2004, as designated in the Project Plans. NAOMS Project management directed Battelle to place emphasis on preparing the air traffic controller survey for field testing; implementing an efficiency plan to reduce costs associated with the air carrier pilot survey; developing and distributing NAOMS-derived products to the aviation community; and, ultimately, finding an organization to accept and establish NAOMS as a permanent service. NAOMS Project management conceded that the NAOMS Project would not be completed by the end of FY 2004 and that the development and implementation of the additional surveys would require another organization to assume the associated added costs.

In April 2003, NAOMS Project management tasked Battelle to explore cost reduction measures that might be achieved using a Web-based application. Battelle conducted research to determine the feasibility of a Web-based survey while continuing to collect and analyze survey data from air carrier and general aviation pilots. By the end of the project's life cycle in December 2004, Battelle had collected data from approximately 25,000 air carrier pilot interviews and 5,000 general aviation pilot interviews.

In 2004, NAOMS Project management placed emphasis on transitioning NAOMS to an interested external organization for permanent service because its parent program, the Aviation Safety and Security Program (AvSSP),<sup>8</sup> was coming to its designed end.<sup>9</sup> The JIMDAT showed particular interest in the NAOMS Project, but not in Section B of the survey. Therefore, NAOMS Project management and Battelle designed a new set of questions for Section C to demonstrate the capability of the survey to monitor and measure safety enhancements introduced into the National Aviation System. Battelle conducted 1,200 interviews and presented its analysis of the responses to the CAST/JIMDAT. Subsequently, ALPA offered to operate NAOMS on behalf of CAST. NASA continued funding the NAOMS Project and efforts continued through 2006 in order to reduce costs associated with conducting the survey and developing and demonstrating a viable Web-based survey. In January 2007, NAOMS Project management transferred NAOMS to ALPA as a Web-based application.

**NAOMS Funding.** Our review of the funding found that funds spent on NAOMS through its life cycle were in line with Battelle's revised proposal (dated August 20, 1999) and with ASMM Project management's original projection of \$8.85 million for the entire Extramural Monitoring element. NASA spent \$11.23 million on NAOMS through FY 2007.

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<sup>8</sup> The AvSP had been renamed in FY 2003.

<sup>9</sup> AvSP/AvSSP had been funded to run from FY 2000 through FY 2004, at which time it was "designed to end."

Total expenditures attributed to the NAOMS Project were calculated using full cost accounting<sup>10</sup> and include

- \$2.79 million spent on NAOMS tasks added to the pre-existing ASRS contract with Battelle in FY 1998 and FY 1999;
- \$6.05 million spent on the NAOMS contract for FY 2000 through FY 2004; and
- \$1.03 million spent from FY 2005 through FY 2007 to transfer the NAOMS methods and technologies to an external organization in the form of a Web-based survey.

### *Execution of the NAOMS Project*

We found that NAOMS Project management adhered to the provisions of project review detailed in NPD 7120.4A and NPG 7120.5A. NAOMS Project management presented the NAOMS concept, methodology, and results at various open forums and allowed for the incorporation of recommendations and suggestions. NPD 7120.4A states that evaluation of NASA projects shall be accomplished through a series of status reviews and independent, or external, readiness reviews. These reviews are intended to enhance the technical and programmatic success of NASA projects by applying the perspective and experience of NASA and non-NASA experts. NPG 7120.5A requires each review and assessment to ensure the benefits of peer experiences and perspectives and to provide opportunities for customer participation. The chronology in Enclosure 2 shows that NAOMS Project management presented appropriate information at various forums attended by NASA program managers and national aviation stakeholders, including the FAA.

We also found that NAOMS Project management achieved several objectives and goals described in the Project Plans. One of the goals of ASMM was to transfer the methods and technology to an interested, independent organization for permanent service, which NAOMS Project management achieved. Additionally, NAOMS Project management demonstrated a survey methodology to quantitatively measure aviation safety, tracked trends in event rates over time, identified effects of new procedures introduced into the operating environment, and generated interest and acceptance of NAOMS by some of the aviation community as described in the Project Plans.

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<sup>10</sup>NASA began budgeting and recording cost using full cost accounting procedures in FY 2004. The concept of full cost accounting ties all Agency direct costs, service costs, and General and Administrative costs to NASA's programs and projects.

### *Deficiencies Noted in the Execution of the NAOMS Project*

We found several deficiencies in the execution of the NAOMS Project. Specifically,

- NASA contracting officers did not adequately specify project requirements nor hold Battelle responsible for completing the NAOMS Project as designed or proposed;
- the contractor underestimated the level of effort required to design and implement the NAOMS survey;
- NASA had no formal agreement in place for the transfer and permanent service of NAOMS; and
- NAOMS working groups failed to achieve their objectives of validating the survey data and gaining consensus among aviation safety stakeholders about what NAOMS survey data should be released.

Additionally, we found that NASA had not adequately described the designed and intended uses of NAOMS data. Specifically, as of February 2008, NASA had not published an analysis of the NAOMS data nor adequately publicized the details of the NAOMS Project and its primary purpose as a contributor to the ASMM Project.

**Contracting Requirements and Performance Incentive.** The initial NAOMS contract with Battelle, and the 17 contract modifications between November 1999 and July 2004, did not specify all NAOMS Project requirements as outlined in the Battelle proposal and Project Plans and did not provide for performance incentives. An Ames Research Center Memorandum for File, “Addendum to Acquisition Plan for Aviation Operations Measurements Systems (AOMS),” June 24, 1999,<sup>11</sup> states the contract will be performance-based; however, the contract did not provide for incentives or require Battelle to complete the NAOMS Project as designed or proposed.

The Federal Acquisition Regulation (FAR), October 10, 1997, Part 35, described contracting for research and development acquisitions, specifying that “the nature of development work often requires a cost-reimbursement completion arrangement.” The contracting officer chose a cost-plus-fixed-fee (CPFF) contract, which was appropriate initially when overall NAOMS requirements were not adequately defined. However, the Project Plans and the Battelle proposal defined the NAOMS requirements, which the field trial confirmed. FAR Subpart 16.4, “Incentive Contracts,” describes cost, performance, and delivery incentives that the contracting officer could have used to motivate the contractor to attain the defined NAOMS Project goals and objectives.

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<sup>11</sup>This document augmented the original Acquisition Plan, dated December 8, 1998.

The Project Plans describe the design and incremental implementation of the NAOMS survey to three primary groups: air carrier pilots; air traffic controllers, mechanics, and cabin crews; and general aviation pilots. Similarly, Battelle's "Mission Suitability Proposal, Technical Services for Aviation Operational Measurement System (AOMS)," July 12, 1999, describes the development and execution of NAOMS over a 3-year period. It also showed three survey groups: air carrier pilots, general aviation pilots, and air traffic controllers. Implementation of the air carrier pilot survey was proposed to begin in the second half of the first year and continue through the end of the third year. Battelle proposed implementing the air traffic controller survey and general aviation pilot survey at the start of the second and third years, respectively, and continuing to the end of the third year. In response to NASA's "Deficiency Report and Clarification Report," Battelle submitted a revised proposal on August 20, 1999, that stated approximately 750 interviews were required to be collected monthly (8,000 to 9,000 annually) from each of the three survey groups in order to collect a statistically significant sample.<sup>12</sup>

In November 1999, NASA Ames Research Center entered into a CPFF contract with Battelle for the development and execution of NAOMS. That contract tasked Battelle to conduct a field trial, complete various pre-implementation steps in preparation for conducting the post-field trial survey, and complete 2,125 air carrier pilot interviews. The contract did not specify any other requirements, although other requirements were described in the Project Plans and Battelle's proposal. For example, the field trial, concluded in January 2000, confirmed that 8,000 interviews per survey group would be required, as suggested in Battelle's proposal. However, no contract modification was issued specifying that requirement or holding Battelle responsible for conducting that number of interviews per survey group. Similarly, none of the modifications established the requirement that Battelle implement the survey incrementally on an annual basis, as specified by Battelle's proposal and the Project Plans. Contract modifications over the life cycle of NAOMS tasked Battelle with conducting varying numbers of interviews with air carrier pilots and general aviation pilots, but not with air traffic controllers.

In addition, the choice of a CPFF contract precluded performance incentives. Several Government Accountability Office (GAO) reports highlight the importance of performance incentives in contracting. For example, "Further Actions Are Needed to Strengthen Contract Management for Major Projects" (GAO-05-123, March 2005)<sup>13</sup> found that the Department of Energy could use performance incentives more effectively for controlling costs and schedules. Although the initial contract tasked Battelle with conducting 2,125 air carrier pilot interviews in the first contract year, the air carrier pilot survey did not begin until April 2001, which was 17 months after the signing of the initial NAOMS Project contract in November 1999. The addendum to the Acquisition Plan

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<sup>12</sup>Battelle's original proposal stated that NAOMS would be capable of detecting a 10 percent shift in the rate of incident occurrences with 80 percent or higher certainty. Following the field trial, NAOMS Project management changed the requirement to detecting a 10 percent shift in the rate of occurrences with 95 percent certainty, which resulted in a survey size estimate of 8,000 to 9,000 respondents per year.

<sup>13</sup>Unrestricted GAO reports are available over the Internet at <http://www.gao.gov/>.

states that incentives were not provided for because Battelle was a not-for-profit corporation. However, performance incentives may have motivated Battelle to complete NAOMS tasks on schedule, as defined in the Project Plans and Battelle's proposal.

The NAOMS Project had a finite timetable that included requirements defined by the Project Plans for which the contractor was only responsible for providing incremental portions without the responsibility for a finished product. The Project Plans stated that NAOMS would include survey data collected from three primary groups. Those surveys would be implemented incrementally on an annual basis over 3 years. Battelle's proposal showed the same requirements. However, Battelle was not contracted to complete those requirements and, therefore, was not responsible for completing the NAOMS Project.

**Developing the NAOMS Survey.** Battelle underestimated the level of effort required to develop the NAOMS survey, which included incorporating suggestions and recommendations from various stakeholders and resulted in a delay from survey development to survey implementation. Battelle conducted the NAOMS field trial from November 1999 through February 2000 and used the findings from the field trial to edit and revise the questionnaire. Additionally, Battelle asked respondents to identify areas that were unclear or needed improvement and to provide suggestions for topics that should be dropped or added. For example, one suggestion was to break into separate air and ground components the survey question: "During the last [time period] how many times did you as a crewmember find that you were unable to communicate with A.T.C. [Air Traffic Control] because of frequency congestion?" Subsequent surveys divided the question into "while on the ground," "while airborne in the terminal area," and "while en route" components. Battelle also considered comments provided by the aviation community and Government agencies following the briefing of the field trial results in March 2000.

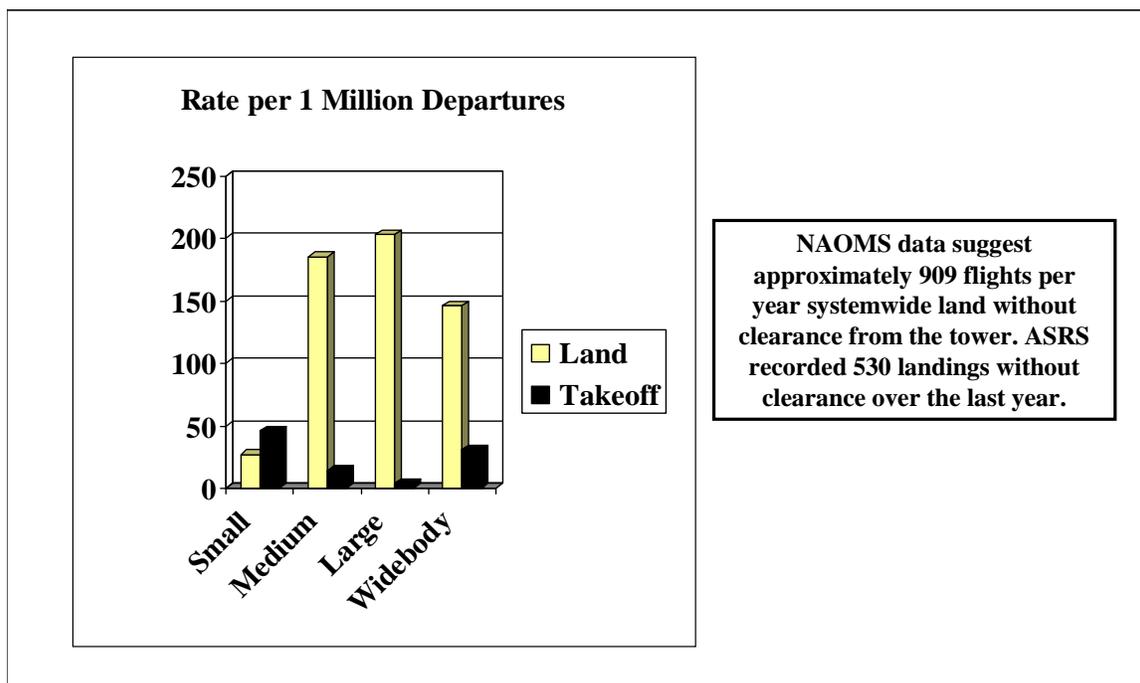
As a result of incorporating suggestions and recommendations from the various stakeholders, Battelle did not implement the air carrier pilot survey until more than a year after the briefing of the field trial results. Additionally, implementation of the general aviation pilot survey did not begin until August 2002 and was suspended by August 2003. Battelle was tasked to draft an air traffic controller survey, but that survey was never implemented.

**Transitioning NAOMS for Permanent Service.** The September 15, 2000, ASMM Project Plan complied with the customer collaboration and partnership agreement requirements set forth in NPG 7120.5A by identifying and collaborating with partners and intended end users of the ASMM Project products. Although NASA and FAA collaborated on the development of ASMM, and the Project Plans identified the FAA as a NAOMS customer and end user, there was no formal agreement between the agencies for the permanent service of NAOMS. As a result, NAOMS Project management had to actively find an organization to accept NAOMS for permanent service after the NAOMS surveys had been developed and implemented. NPG 7120.5A did not require a formal agreement, but we are not making a recommendation about this issue because draft NPR 7120.8, "NASA Research and Technology Program and Project Management

Requirements,” contains a provision to “[l]ist the external agreements necessary for R&T [Research and Technology] Portfolio Project success and projected dates of approval.”

In December 2002, NAOMS Project management presented a NAOMS Project overview to the NASA Aviation Safety and Security Program Office. The presentation included Battelle’s preliminary analysis of the nearly 12,000 air carrier pilot interviews completed since April 2001. As annotated on the presentation slide in Figure 2, NAOMS Project management recognized that the NAOMS data indicated event rates greater than that of other aviation safety databases.<sup>14</sup>

**Figure 2. Rates of Takeoffs or Landings without Clearance from Tower**



Source: December 5, 2002, presentation to AvSSP Office

The FAA was concerned with the results of the survey and the data presented, expressing a lack of confidence in the survey methodology due to the event rates indicated by the survey data. During our review, we noted a disparity between the stated goals of NAOMS and the manner in which NAOMS Project management initially presented the data to the FAA. In an April 2003 presentation to the FAA in Washington, D.C., NAOMS Project management stated that the goal of NAOMS was to create a new national capability that would quantitatively

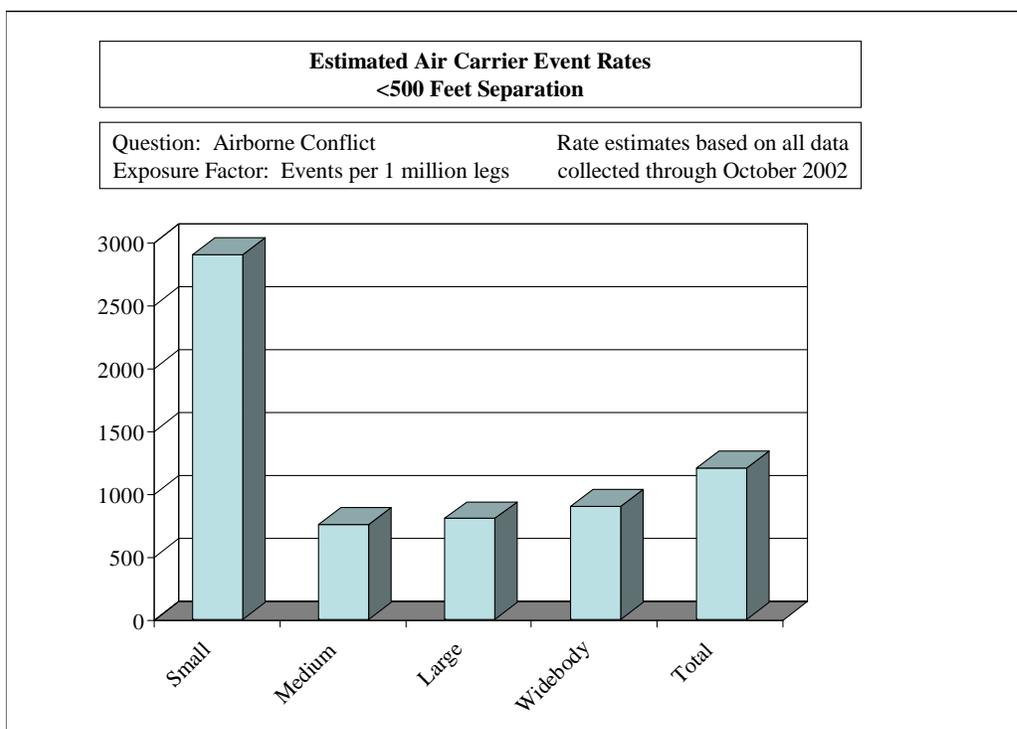
- track aviation safety *trends* [emphasis added];

<sup>14</sup>Depending on the specific event, rates were presented in various formats, such as the number of events per 100,000 flight hours or events per 1 million departures or legs.

- monitor the impacts of technological and procedural changes introduced into the aviation system; and
- contribute to the development of a system that would use data as a basis for safety decisions.

However, the presentation’s graphics showing the results of the collected data only showed *rates* of events, as illustrated in Figure 3. Although identified as “rate estimates,” the presentation did not emphasize the preliminary nature of the data or that the findings indicated by the data would be integrated with other data sets to identify safety concerns requiring further investigation.

**Figure 3. Rates of Airborne Conflicts**



Source: April 2003 NAOMS Management presentation to FAA

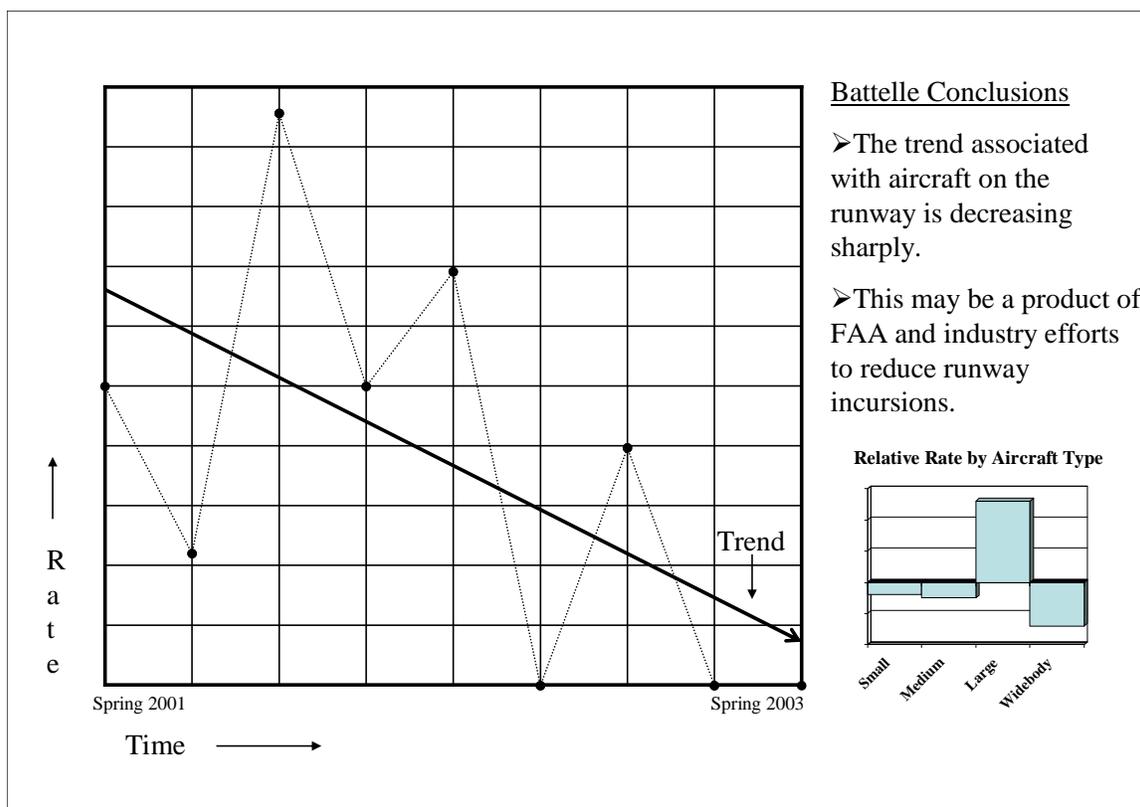
By August 2003, NAOMS Project management recognized that the FAA was not convinced of the utility of NAOMS. The presentation that month to the FAA in Newport, Rhode Island, placed greater emphasis on the data being a contributor to other aviation safety databases rather than simply an indicator of event rates. For example, NAOMS Project management modified the goals presented in April 2003 to include additional emphasis on NAOMS as an indicator of areas where improvement could have the greatest impact and on the corroboration and integration of findings with industry and Government groups. Other presentation slides pointed out that “NAOMS measures event occurrence, not causes. Notable trends or findings require *additional* investigation.” The summary slide also stated: “The NAOMS survey is designed to expose areas that need

further investigation.” Following that presentation, FAA and NASA representatives at the meeting agreed not to release the survey results before NAOMS working groups were established and had reviewed and discussed the results.

NAOMS Project management presented a plan to form working groups with the aviation community and Government stakeholders to ensure that the results were valid and to gain consensus on the content, level, and timing of the release of NAOMS data. NAOMS Project management also intended the working groups to build community support for NAOMS. NAOMS Project management proposed that these working groups would meet four times a year.

The first NAOMS Working Group meeting took place in December 2003. More than 18,000 air carrier pilot interviews had been completed by that time. NAOMS had demonstrated the ability to show trends in National Aviation System safety and to identify potential factors driving those trends. Battelle had actively calculated relative rates, determined trends of surveyed events, and postulated what caused the change in the rates of those events, as illustrated in Figure 4, and presented them at the meeting.

**Figure 4. NAOMS Event Rate Trends – Ground Conflict with Aircraft on Runway**

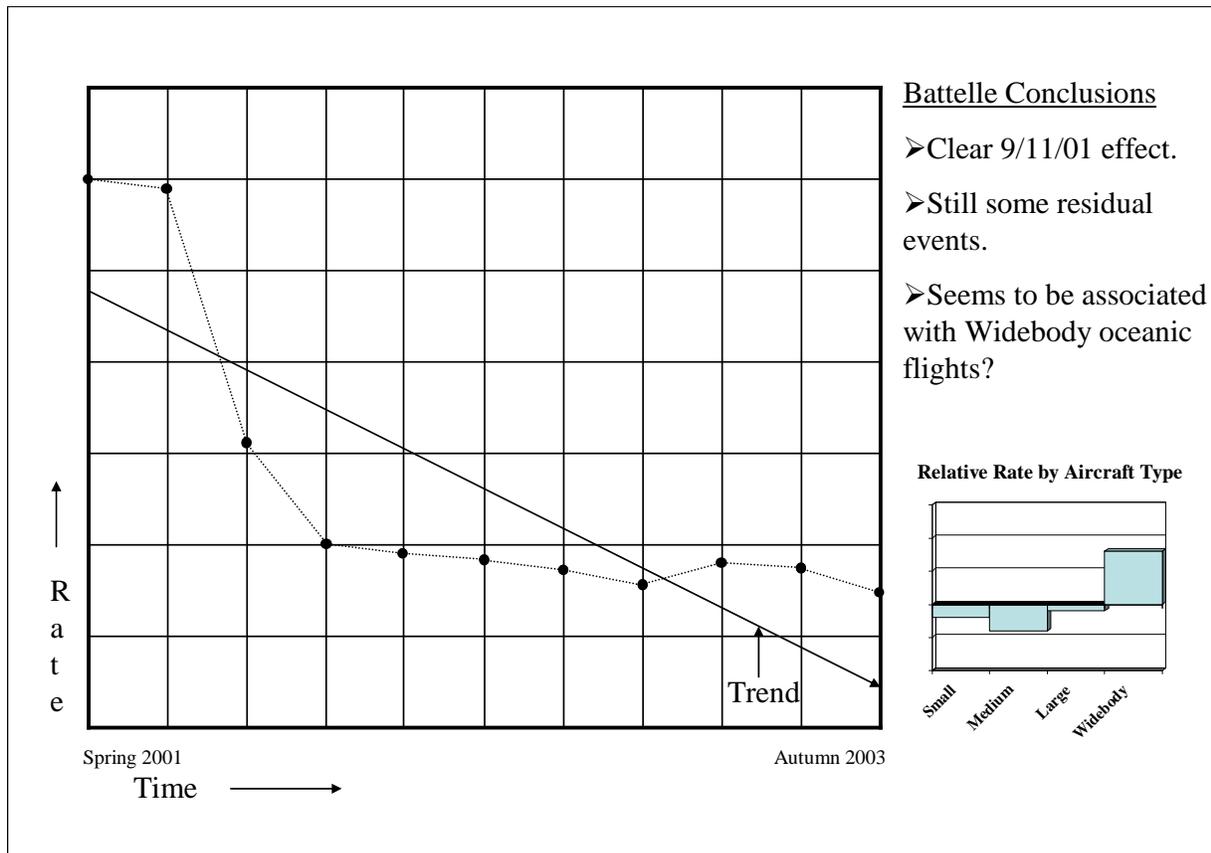


Source: December 18, 2003, Working Group meeting

The next NAOMS Working Group meeting was in May 2004. Battelle continued to add to the survey database and presented trends that attempted to demonstrate the correlation

between the NAOMS data and procedural changes in the National Aviation System. As illustrated in Figure 5, measures enacted subsequent to the events of September 11, 2001, provided an unintentional opportunity to demonstrate the ability of NAOMS to identify safety and efficiency effects of procedural changes.

**Figure 5. NAOMS Event Rate Trends – Pilot Left Cockpit Due to Passenger Disturbance**



Source: May 5, 2004, Working Group meeting

However, the two Working Group meetings did not reach a consensus concerning the validity of the data, which resulted in a lack of community support for NAOMS. Aviation community and Government stakeholders did not interpret or formally evaluate the data for relevance as an indicator of aviation safety. Because NASA had agreed not to release the survey results until the Working Group had validated the data, NAOMS Project management did not release any results from the collected survey data.

With the AvSSP coming to its designed end, NAOMS Project management did not hold any other Working Group meetings to validate the survey data. Instead, NAOMS Project management expended a significant amount of time and resources finding a new organization to accept NAOMS for permanent service and demonstrating the value of NAOMS to that new customer: the Joint Implementation Data Analysis Team (JIMDAT) of the Commercial Aviation Safety Team (CAST). CAST/JIMDAT was interested in the

NAOMS Project in order to monitor and measure safety enhancements introduced into the National Aviation System, but had little interest in benchmarking safety events (Section B). In July 2004, NAOMS Project management contracted with Battelle to modify Section C of the survey for evaluation by CAST/JIMDAT. Battelle designed a Section C instrument to enable collection of baseline measurements to support an evaluation of CAST/JIMDAT safety interventions. Additionally, Battelle was to evaluate the Internet as an alternative method of collecting NAOMS survey data. Both the CAST/JIMDAT evaluation of Section C and Battelle's evaluation of the Internet as an alternative means to collect NAOMS data were positive. As a result, NASA funded the NAOMS Project in FYs 2005 through 2007 in order to develop the survey as a Web-based application and transfer NAOMS for permanent service. In January 2007, NAOMS was transferred to ALPA, which had offered to permanently operate the service on behalf of CAST.

### ***NASA Could Do More to Disclose NAOMS Project Information***

On December 31, 2007, NASA established a Web site<sup>15</sup> for NAOMS that provided previously unreleased information on the NAOMS Project. Specifically, NASA posted to the Web site portions of the raw survey data in addition to Battelle's report, "NAOMS Reference Report: Concepts, Methods, and Development Roadmap," November 30, 2007. However, the Web site did not include publications that could add to the public's understanding of NAOMS. Specifically, the article, "Beyond Error Reporting Toward Risk Assessment,"<sup>16</sup> which demonstrated the NAOMS survey data contribution to ASMM, and NASA Technical Publication, "The Aviation System Monitoring and Modeling (ASMM) Project: A Documentation of Its History and Accomplishments: 1999–2005," were not available on the Web site or elsewhere over the Internet. Both of these documents describe the intended use of the NAOMS survey data, and the data's contribution to the ASMM Project, as well as the other associated products developed to support the ASMM Project.

The usefulness of the NAOMS raw data posted on the NASA-NAOMS Web site has been called into question.<sup>17</sup> Battelle designed the survey with pilot confidentiality in mind, and survey respondents indicated that they were confident the survey provided for their confidentiality. However, because NAOMS did not provide for the limited immunity from FAA prosecution afforded to pilots for reports filed via ASRS, NASA had concerns that someone could use the NAOMS data to identify particular pilots or airlines based on their survey responses. As a result, NASA had Battelle remove

<sup>15</sup><http://www.nasa.gov/news/reports/NAOMS.html> (updated January 14, 2008; accessed February 4, 2008).

<sup>16</sup>"Beyond Error Reporting Toward Risk Assessment," *Proceedings of the 12th International Symposium on Aviation Psychology*, April 2003, Dayton, Ohio.

<sup>17</sup>Mathew L. Wald, "NASA Offers Airline Safety Data," *The New York Times*, January 1, 2008 (accessible as of February 4, 2008, at <http://www.nytimes.com/2008/01/01/us/01nasa.html>).

identifying information before releasing the NAOMS survey data and the Battelle report that are posted on the NASA-NAOMS Web site.

The redacted data did not include analysis by NAOMS Project management. NAOMS Project management personnel stated that they had intended to publish an analysis of the NAOMS data; however, at the conclusion of the data collection efforts, NAOMS Project management concentrated its efforts on establishing NAOMS as a Web-based application and transferring NAOMS to ALPA. Additionally, following the release of the Associated Press article, NASA directed NAOMS Project management not to analyze the data or produce a report on NAOMS, citing the inability of a report to complete NASA's review process by December 31, 2007. NASA has agreed to contract with the National Research Council (NRC) to conduct an independent assessment of the NAOMS methodology that will describe "its potential limitations, likely sources of error and estimates of their magnitude, the potential utility of the data, and recommendations for such use."<sup>18</sup> However, this assessment of the methodology will not provide analysis of the NAOMS data that could result in findings and conclusions to help understand the aviation safety environment that existed from 2001 to 2004.

While NAOMS data alone may have some value, NAOMS was not intended or developed to stand alone, and the true value of its data cannot be accurately assessed without comparison and reconciliation with other data sets. The National Academy of Sciences recognized this fact in its 2004 report, *Review of NASA's Aerospace Technology Enterprise: An Assessment of NASA's Aeronautics Technology Programs*,<sup>19</sup> which recommended that NASA "combine the National Aviation Operations Monitoring Service methodology and resources with the Aviation Safety Reporting System program data to identify aviation safety trends." Collaborating with other aviation community and Government stakeholders to interpret and reconcile the NAOMS data with other aviation safety data may determine its value as a contributor to preventing aviation mishaps.

NASA did not adequately articulate to the public that NAOMS was one product within the element of Extramural Monitoring, which was one of four elements within the ASMM Project of NASA's Aviation Safety Program. ASMM Project management designed the products and their associated data to be merged into a systemwide framework that would enable aviation policymakers to analyze safety risks, make recommendations for change, predict the effects of changes, and then analyze those effects.

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<sup>18</sup>From an e-mail that Administrator Michael Griffin sent to NASA employees concerning NAOMS, January 14, 2008 (accessible as of February 4, 2008, at [http://www.nasa.gov/pdf/208249main\\_Griffin%20NAOMS%20letter.pdf](http://www.nasa.gov/pdf/208249main_Griffin%20NAOMS%20letter.pdf)).

<sup>19</sup>Committee for the Review of NASA's Revolutionize Aviation Program, Aeronautics and Space Engineering Board, Division of Engineering and Physical Sciences, National Research Council of the National Academies. *Review of NASA's Aerospace Technology Enterprise: An Assessment of NASA's Aeronautics Technology Programs* (Washington, D.C., National Academies Press, 2004, National Academy of Sciences). Accessible as of February 4, 2008, at [http://www.nap.edu/catalog.php?record\\_id=10861](http://www.nap.edu/catalog.php?record_id=10861).

### ***Management's Comments on the Finding and Evaluation of Management's Comments***

The Associate Administrator for Aeronautics Research provided general and specific comments in response to our February 19, 2008, draft of this memorandum (see Enclosure 3 for the full text of management's comments). Although we considered these comments in preparing this final memorandum, and made some changes as the result of coordination with ARMD personnel, we did not make specific changes to address the following concerns.

**Management's Comments on NPG 7120.5 Reviews and Peer Reviews.** The Associate Administrator had several concerns with our conclusion that the NAOMS Project had adhered to the provisions of NPG 7120.5A, as articulated in the following statements:

- ARMD does not believe that key programmatic issues were properly reviewed. The concern with data quality and the resulting impact to dissemination was never properly briefed to program management or other stakeholders.
- ARMD has reservations about the composition and independence of the evaluating group that conducted the reviews of NAOMS.
- ARMD has serious reservations about the lack of technical peer review of the NAOMS methodology.

**Evaluation of Management's Comments.** The Associate Administrator stated that by concluding the NAOMS Project had adhered to the provisions of NPG 7120.5A, we inferred that peer review was satisfied. We did not evaluate NAOMS Project management in regard to peer review because NPG 7120.5A does not provide a definition or guidance for the execution of peer review. NPG 7120.5A only provides broad guidance for project and program review. In that guidance, the NPG states, "The conduct of each review and assessment shall ensure the benefits of peer experiences and perspectives and shall provide opportunities for customer participation." Based on the composition and audience of the many presentations and NAOMS Project management actions following presentations, we concluded that the NAOMS Project had met the intent of the guidance.

Presentations to various audiences and documented communications show that Aviation Safety Program personnel were aware of the issues concerning the NAOMS data and the purpose of the working groups. ASMM and Extramural Monitoring Project Plans defined the customers and external partners involved in ASMM and the planning and execution of NAOMS. Therefore, we concluded that higher-level program management and other aviation stakeholders, including the stated customers, were aware of the NAOMS data issues.

**Management's Comments on Inference of NAOMS' Success.** The Associate Administrator commented that our statement, "the NAOMS Project demonstrated a

survey methodology to quantitatively measure aviation safety . . . and generated interest and acceptance of NAOMS by some of the aviation community” may be incorrectly perceived by some readers that the NAOMS methodology was successfully demonstrated. In addition, the Associate Administrator stated that due to the lack of documentation and subsequent technical peer review, it is impossible to make this claim.

**Evaluation of Management’s Comments.** As described in our scope and methodology discussion (see Enclosure 1), we did not assess the validity of the data or the NAOMS survey methodology. Our conclusion that some of the aviation community accepted NAOMS was based on ALPA accepting NAOMS for permanent service in January 2007.

### *Recommendations, Management’s Response, and Evaluation of Management’s Response*

**Revised Recommendation.** In consideration of management’s comments in response to draft Recommendation 2.b, we modified that recommendation.

**Recommendation 1.** We recommended that the Associate Administrator for Aeronautics Research lead and coordinate the efforts of aviation community and Government stakeholders to collaborate and interpret the raw NAOMS data to determine whether the data were useful for NAOMS’ intended purpose: to produce data from which trends might be identified and considered in concert with other ASMM activities.

**Management’s Response.** The Associate Administrator concurred with the recommendation, stating that there is a need to determine whether NAOMS accomplished its intended purpose of producing data from which trends might be identified and considered in concert with other ASMM activities. However, the Associate Administrator stated that NASA’s primary role should be to determine the viability of the concept, which is consistent with the primary research goals of NAOMS. Therefore, a better understanding of the NAOMS methodology and its limitations is needed instead of an analysis of the raw data. ARMD will focus on determining whether the methodology is sound and whether the NAOMS methodology would be useful in future aviation safety analyses. Consequently, ARMD has initiated a contract with the NRC to conduct an independent assessment of the NAOMS methodology. The estimated completion date of the NRC assessment is June 30, 2009.

**Evaluation of Management’s Response.** The intent of our recommendation was to determine whether the NAOMS research produced valid data from which safety trends might be identified. We recognize that, as an alternative to interpreting the raw data, validating the NAOMS survey methodology is a reasonable and vital step in making that determination. ARMD’s planned action to validate the methodology and investigate its applicability to future aviation safety analyses is, therefore, responsive to the intent of the recommendation. The recommendation is resolved and will be closed upon completion and verification of management’s action.

**Recommendation 2.a.** We recommended that the Associate Administrator for Aeronautics Research release and post on NASA’s public Web site NAOMS-related information, to include the articles and other research papers associated with NAOMS and ASMM.

**Management’s Response.** The Associate Administrator concurred, stating that ARMD has actively supported publishing all relevant NAOMS and ASMM material and will post links to such documents, including the NRC report, as they become available. Subject to adherence to public release guidelines, ARMD intends to post the article, “Beyond Error Reporting Toward Risk Assessment,” and NASA Technical Publication, “The Aviation System Monitoring and Modeling (ASMM) Project: A Documentation of Its History and Accomplishments: 1999–2005,” on the NASA-NAOMS Web site by April 30, 2008.

**Evaluation of Management’s Response.** ARMD’s planned action is responsive. We recognize that updating the NASA-NAOMS Web site is a continuing process, as evidenced by the update on February 6, 2008. The recommendation is resolved and will be closed upon completion and verification of management’s action.

**Recommendation 2.b.** If the NRC study validates the NAOMS survey methodology, we recommend that the Associate Administrator for Aeronautics Research release and post on NASA’s public Web site a detailed report published by NAOMS Project management that includes an analysis of the NAOMS research and findings and conclusions gained from the survey data.

**Management’s Response.** The Associate Administrator nonconcurred with our draft recommendation, stating that ARMD does not intend to publish a detailed report for the following reasons:

- due to the lack of technical publications since the inception of the NAOMS Project, there is little confidence that a thorough and accurate report can be produced, and
- there is diminishing value in the NAOMS data for assessing the state of the current aviation safety environment.

Additionally, the Associate Administrator questioned the relevance of analyzing NAOMS data that is several years old, considering that new ways to collect and analyze aviation operational data have been put in place since NAOMS data was last collected. The Associate Administrator stated that the most important work related to NAOMS is to better understand the validity of the survey methodology and, consequently, resources could be put to better use in connection with the Next Generation Air Transportation System.

**Evaluation of Management’s Response.** We consider the Associate Administrator’s comments partially responsive. The intent of our recommendation

was to bring closure to the NAOMS Project in accordance with draft NPR 7120.8, which states that the “Project Lead should ensure publication of at least one peer-reviewed technical paper or the posting of a final report external to NASA to ensure wide dissemination of technical information.” Although we maintain that valuable insight into the aviation safety environment might be gained from analyzing the collected data and publishing findings and conclusions, we recognize that the NAOMS survey methodology may prove to be the most useful component of the NAOMS Project and that the data itself may be of little use in evaluating the current aviation safety environment. Therefore, we revised our recommendation to take into consideration that the NRC study will assess the NAOMS methodology.

We request that the Associate Administrator for Aeronautics Research provide additional comments on Recommendations 2.b in response to this final memorandum. The additional comments should address the intended uses of the collected NAOMS data if the NRC study validates the NAOMS survey methodology. We request that management provide the additional comments by April 30, 2008.

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

signed

Evelyn R. Klemstine

3 Enclosures

cc:

Chief, Safety and Mission Assurance

## Scope and Methodology

We performed this review from November 2007 through February 2008 in accordance with generally accepted government auditing standards. Those standards require that we plan and perform audits to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained during this review provides a reasonable basis for our findings and conclusions based on our objectives.

We initially concentrated our efforts on gaining an understanding of the background of NAOMS, including its history, funding, and objectives, and the intended use of the collected survey data. We traveled to Ames Research Center and held interviews with the head of NASA's Human Systems Integration Division, NAOMS and ASMM Project management personnel, Battelle personnel, and the NAOMS Project survey methodologist. At NASA Headquarters, we interviewed personnel who had been involved in NAOMS, including the Aviation Safety Program Director at the time, the FAA representative to NASA at the time, the NAOMS principal investigator, and the current staff of NASA's Aeronautics Research Mission Directorate.

To determine the adequacy of NAOMS Project and contract management, we compared NAOMS Project management actions with the criteria contained in NPD 7120.4A and NPG 7120.5A. We reviewed applicable documentation, including the CPFF contracts between Ames Research Center and Battelle and the associated NASA Forms 1680;<sup>20</sup> presentations prepared by Battelle and NAOMS management; Battelle's Field Trial Training Manual; and Extramural Monitoring and ASMM Project Plans from 1999, 2000, and 2004.

For our review of funding, we analyzed the original estimate of NAOMS planned funding requirements using Battelle's "Cost and Price Proposal," July 12, 1999, and Battelle's "Response to NASA's Deficiency Report and Clarification Report,"<sup>21</sup> August 20, 1999; compared them with the 1999 Extramural Monitoring and 2000 ASMM Project Plans; and evaluated the funds actually expended.

We did not assess the validity of the data or the NAOMS survey methodology because that was beyond the scope of our review, as were issues related to the confidentiality of the data.

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<sup>20</sup>NASA Form 1680, "Evaluation of Performance," July 2000.

<sup>21</sup>After Battelle's proposal was submitted, ASMM Project management submitted "Clarification Report and Deficiency Report" to obtain clarification of and corrections to the proposal.

**Computer-Processed Data.** We did not use computer-processed data to perform this review. Although Battelle used NAOMS data in the development of the presentations showing event rates and trends, our review focused on the management of NAOMS. Therefore, the reliability and validity of the data have no impact on our conclusions.

**Prior Coverage.** Though not specific to NAOMS or ASMM, the NASA OIG report, “NASA’s Aviation Safety Program” (IG-00-053, September 26, 2000), highlighted various challenges NASA had to ensure the success of its Aviation Safety Program. Those challenges included the technical development of products, user implementation of the resulting technology, and availability of resources (staffing, time, and dollars). The audit concluded that some of the goals were optimistic and could lead to unfulfilled expectations by Congress, the aviation community, and the public. The report can be accessed over the Internet at <http://www.hq.nasa.gov/office/oig/hq/audits/reports/FY00/index.html>.

## Chronology of NAOMS Presentations

- 1997.
  - Concept for monitoring presented to the ASRS Advisory Committee.
  - Concept for monitoring reviewed and commented upon at an international workshop held at NASA Headquarters.
- 1998.
  - Proposal for monitoring presented to the Flight Safety Foundation Icarus Committee's Working Group on Flight Operational Risk Assessment System.
  - Monitoring concept described to representatives of the FAA Office of System Safety.
- 1999. Methodology for the NAOMS Survey, presented at the "Workshop on the Concept of NAOMS," Alexandria, Virginia.
- 2000. Field Trial Results, presented at "NAOMS Workshop," Washington, D.C.
- 2002. NAOMS Project Overview, presented to the NASA Aviation Safety and Security Program Office, Langley, Virginia.
- 2003.
  - NAOMS Overview and Status, presented to the FAA, Washington, D.C.
  - NAOMS Program Review, presented to the National Research Council, Ames Research Center
  - NAOMS Overview and Status, presented to the FAA/JIMDAT/CAST, Newport, Rhode Island.
  - NAOMS Survey methodology, including design decisions and scientific basis, presented at "NAOMS Working Group Meeting #1," Seattle, Washington.
- 2004. NAOMS Survey methodology (NAOMS design decisions), presented to the National Transportation Safety Board, Washington, D.C.

## Management's Comments

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



24 March 2008

Reply to Attn of Aeronautics Research Mission Directorate (ARMD)

TO: Assistant Inspector General for Auditing  
FROM: Associate Administrator for Aeronautics Research  
SUBJECT: Response to Draft Memorandum dated February 19, 2008 on the Review of the National Aviation Operation Monitoring Service (Assignment No. S-08-004-00)

Upon reviewing the draft memorandum, we want to first commend the Office of Inspector General (OIG) staff on their thorough and comprehensive efforts to investigate the history and status of the National Aviation Operation Monitoring Service (NAOMS) research activity.

In this memo, we have provided the Agency's response to the two OIG recommendations. While we agree with most of the findings, we have several points of disagreement which are documented below.

**OIG Recommendation 1:**

"Lead and coordinate the efforts of aviation community and Government stakeholders to collaborate and interpret the raw NAOMS data to determine whether the data were useful for NAOMS' intended purpose: to produce data from which trends might be identified and considered in concert with other Aviation System Monitoring and Modeling (ASMM) activities."

**ARMD Response: Concur, with Comment**

In the case of NAOMS, there are still differing opinions regarding its potential safety contribution relative to other safety enhancements that have been implemented by the aviation community. Given these diverse opinions, ARMD concurs with the basic OIG recommendation #1 that there is a need to determine if NAOMS accomplished its intended purpose of producing data from which trends might be identified and considered in concert with other ASMM activities. In order to make this determination, a better understanding of the NAOMS methodology and its inherent limitations are needed instead of an exhaustive analysis of the raw NAOMS data. Consequently we have initiated a contract with the National Research Council (NRC) to conduct an independent assessment of the NAOMS methodology. We do not intend to proceed with a coordinated interpretation of the raw data beyond what is needed by the NRC to validate whether the methodology is sound. [Estimated Completion Date of NRC assessment: June 30, 2009]

With respect to a detailed interpretation of the NAOMS data, this work is more appropriately conducted by other organizations with an operational mission. NASA's primary role should be to determine the viability of the concept which is consistent with the primary research goals of

1 of 5

the project. ARMD will focus on determining if the methodology is indeed sound and if there is a future need and role for similar methodologies in safety analysis.

Another important consideration is that the most recent NAOMS data was collected in 2004 and the potential value of the data to assessing the current aviation safety environment diminishes over time. Therefore the principle potential value of the project is in the methodology and not data.

**OIG Recommendation 2.a:**

“Release and post on NASA’s public Web site NAOMS-related information, to include the articles and other research papers associated with NAOMS and ASMM.”

**ARMD Response: Concur**

ARMD has actively supported publishing all relevant NAOMS and ASMM material. As part of the Agency’s NAOMS web posting on February 6, 2008, we included all of the NAOMS briefings that were available to us, as well as a copy of the ASMM project plan from 2004. ARMD intends to post, subject to approval of public release guidelines, the two documents specifically mentioned in the IG report that would add to the public’s understanding of NAOMS (“Beyond Error Reporting Toward Risk Assessment” and “The Aviation System Monitoring and Modeling (ASMM) Project: A Documentation of Its History and Accomplishments: 1999-2005”). [Estimated Completion Date of Postings: April 30, 2008] Additionally, ARMD will post other valid NAOMS related documents such as the NRC report as they become available.

**OIG Recommendation 2.b:**

“Release and post on NASA’s public Web site NAOMS-related information, to include a detailed report published by NAOMS Project management that includes an analysis of the NAOMS research and their findings and conclusions gained from the survey data.”

**ARMD Response: Non-Concur**

ARMD does not intend to publish a detailed report produced by the NAOMS Project management on NAOMS for the following reasons. First, due to the lack of technical publications since the Project’s inception, there is little confidence that the Project can produce a thorough and accurate report. Second, as mentioned above, there is diminishing value in the NAOMS data for assessing the state of the current aviation safety environment. Therefore given these two reasons, ARMD resources can be put to better use in conducting research toward enabling the Next Generation Air Transportation System (NextGen). We believe that the most important work related to NAOMS is to better understand the validity of the survey method as described in recommendation #1. In this case, the NRC is able to provide an independent assessment of this capability.

Lastly, the aviation system is continuously updating and improving, thus we question the relevance to the community of analyzing data that is several years old. Since 2004 when the NAOMS data was last collected, new activities have been put in place to collect and analyze aviation operational data. In particular the Aviation Safety Information Analysis and Sharing (ASIAS) system was implemented by the FAA and aviation community in 2007 to collect and integrate operational data in order to look for trends and/or anomalies that could be an indicator of unsafe conditions. NASA will continue to work with the aviation community in a collaborative manner to advance the ASIAS capabilities in order to meet future needs of the NextGen.

### **Additional Concerns**

In addition to addressing the specific recommendations, we would like to comment on other aspects of the OIG report. There are two major points in the Draft Report on NAOMS that ARMD disagrees with, and we want to provide you with our reasons for the disagreement: (1) your statement that compliance with NPG 7120.5 satisfies peer review and (2) the inference that NAOMS successfully demonstrated a new methodology for safety analysis. Finally, at the end we also include some minor observations that may also be considered.

#### **NPG 7120.5 Reviews and Peer Review:**

In your draft memo, under the heading of "Execution of the NAOMS Project," you state that the NAOMS project adhered to NPG 7120.5, with an inference that peer review was satisfied. However, we believe that key programmatic issues were not properly reviewed. For example, your report cites the fact that the FAA was concerned about the quality of some of the data and asked the NAOMS Project Management to withhold release of results until they could be further analyzed. This function was intended for the NAOMS working groups, but was never accomplished. From the briefings provided to ARMD it is not clear that the concern with data quality and the resulting impact to dissemination was ever properly briefed to program management or other stakeholders. This is a critical concern for this type of project.

In addition to concerns about the lack of issues briefed at these reviews, we also have reservations about the composition and independence of the evaluating group conducting the NAOMS reviews. With the exception of the 2004 NRC review, we have not seen evidence that an independent group was chartered to conduct an evaluation of the project. Instead, there have been a number of presentations to the stakeholder community. While it is generally acknowledged that these presentations were made to aviation safety subject matter experts and user community, it is not apparent at all how such groups were assembled and whether the selection and makeup of the stakeholder groups satisfied the guidelines provided by NPG 7120.5 for an independent review.

The types of reviews covered in NPG/NPR 7120 are generally focused on programmatic and technical issues that impact an entire program or project. The NPG/ NPR 7120 also indicates that certain reviews will analyze more specific aspects of a project such as a Critical Design Review or Flight Readiness Review for a flight program. While these specific reviews are usually not applicable to research projects, technical peer review has long been regarded as a critical element in ensuring the reliability of scientific analyses by the technical and scientific community. These technical peer reviews usually focus on specific aspects of a technical approach. An important aspect of research is proper documentation and dissemination of the methods and results. In addition to ensuring that ideas are recorded and shared, this provides the basis for conducting a technical peer review. Typically this documentation will take the form of journal articles and NASA Technical Publications. NPR 2200.2B discusses some of the review requirements for these publications. With the exception of PowerPoint presentations and high level reports, the NAOMS project is not well documented and has not been reviewed by subject matter experts with detailed knowledge in related technical areas such as statisticians, behavioral scientists, or others with expertise in survey methodologies and data analysis. Therefore, ARMD has serious reservations about the lack of technical peer review of the NAOMS methodology.

#### **Inference of NAOMS Success**

On page 9 of the report you state that “the NAOMS Project Management demonstrated a survey methodology to quantitatively measure aviation safety...” and that this “generated interest and acceptance of NAOMS by some of the aviation community.” This is a broad claim that may be perceived by many readers that NAOMS *successfully* demonstrated this method. However, due to the lack of documentation and subsequent technical peer review it is impossible to make this claim. The report does make it clear that there were concerns with the data in the stakeholder community. However, this section is not clear in identifying what aspects of the NAOMS were accepted by the aviation community. The concerns raised about disagreement of the section B results have never been explained or analyzed and therefore we do not agree with the claim that the use of this methodology has been demonstrated. We do acknowledge that it is possible that there is indeed a logical explanation for this difference, but this has never been stated. It is our hope that the planned NRC assessment will provide additional insight into this issue.

#### **Additional Issues**

On page 4 of the report the statement is made that the opportunity to gain a deeper understanding of the aviation safety system was due to a failure of the NAOMS working groups. We agree that the NAOMS working groups failed to validate and verify the data and also develop a dissemination plan, but this was also the responsibility of the project and program leadership. Briefings presented by the NAOMS project leadership to the aviation community showed no clear plan for the dissemination of data. Prior to the establishment of the working groups, the NAOMS project should have had a clear understanding of what data it intended to collect and should have determined who could have access to it given its sensitive nature as part of a well defined dissemination plan. This would have improved the verification and validation process that followed and clarified the dissemination approach. It is our position that the project and program leadership should have also placed a greater emphasis on validation and verification of the methodology instead of focusing on transitioning a method that had not been proven.

On page 17 there are questions about the usefulness of data published on the ARMD website including a lack of publications that could add value to the public’s understanding of NAOMS. We agree that there is a lack of publications concerning NAOMS, but NASA has continued to update the website with additional information since the time of the initial IG report.

In the paragraph at the top of page 18 it is stated that ARMD directed the NAOMS project not to analyze the data because they could not complete it by 31 December 2007. While it is true that there is no practical way that the project had enough time to publish an analysis before the data release on 31 December 2007, there are additional concerns with the Project’s plan to analyze the data. One concern is that the NAOMS Project Management did not have a sufficient plan to thoroughly analyze the methodology before attempting to draw conclusions about the trends indicated by the data. This concern was realized because of the inability of the project to conduct any in-depth technical analysis in the preceding five years of the project (even after a substantial amount of data had been acquired).

We appreciate the opportunity to provide the facts that countered the impression that FAA was impeding NASA’s release of NAOMS reports or analyses. We concur with the updated text provided by the OIG to clarify this concern. However, we feel that it should be clear that the decision to withhold data was NASA’s sole responsibility even though the NAOMS working groups were asked to develop a release strategy.

Thank you and your staff on your thorough and comprehensive efforts to investigate the NAOMS research activity, and for allowing us the opportunity to comment on your findings and recommendations.

Sincerely,

A handwritten signature in black ink, appearing to read 'Jaiwon Shin', with a long horizontal flourish extending to the right.

Dr. Jaiwon Shin  
Associate Administrator for  
Aeronautics Research Mission Directorate