

National Aeronautics and
Space Administration



Office of Inspector General
Washington, DC 20546-0001

March 31, 2008

TO: Associate Administrator for Science
Director, Goddard Space Flight Center
Chief Financial Officer, Goddard Space Flight Center

FROM: Assistant Inspector General for Auditing

SUBJECT: Final Memorandum on Audit of NASA's Global Precipitation
Measurement Project (Report No. IG-08-016-Redacted; Assignment
No. A-07-014-00)

The Office of Inspector General (OIG) conducted an audit of NASA's Global Precipitation Measurement (GPM) Project. The GPM Project is a part of NASA's next generation of satellite-based missions that will contribute to the U.S. Climate Change Science Program and the U.S. Weather Research Program. We initiated this audit because budget reductions in previous years delayed the GPM Project's original launch date in 2007 to the current launch date in 2013. In addition, the January 2007 National Academy of Sciences' *Earth Science and Applications from Space: National Imperatives for the Next Decade and Beyond* (Decadal Survey)¹ emphasized the importance of the GPM Project and that the viability of GPM will depend on NASA's commitment to a firm launch schedule.

The objective of the audit was to determine whether further schedule delays to the GPM Project would result in significant risks to the Project and whether NASA had taken steps to mitigate those risks. Specifically, we assessed whether NASA was taking the appropriate steps to mitigate and plan for potential cost overruns and schedule delays to the GPM Project. In addition, we evaluated whether NASA was taking steps to ensure that its international partner, Japan Aerospace Exploration Agency (JAXA), and its contractor would not abandon the Project. We also reviewed internal controls as appropriate. See Enclosure 1 for details on the audit scope and methodology.

Executive Summary

We found that NASA was taking steps to mitigate risks of further schedule delays to the GPM Project. However, funding shortfalls in fiscal years (FYs) 2005 through 2007

¹ The Decadal Survey is the National Research Council's response to a request from NASA's Earth Science Division, Science Mission Directorate; the National Oceanic and Atmospheric Administration's National Environmental Satellite Data and Information Service; and the U.S. Geological Survey's Geography Division. The Survey was to generate consensus recommendations from Earth and environmental science and applications communities regarding (1) high-priority flight missions and activities to support national needs for research and monitoring of the dynamic Earth system during the next decade, and (2) important directions that should influence planning for the decade beyond.

caused delays to the delivery schedule of the Project's only prime contract, the GPM Microwave Imager (GMI). Those schedule delays have resulted in increasing GPM Project costs. Additionally, NASA's partnership with JAXA could be negatively impacted if the Project incurs any further delays.

On April 25, 2007, the GPM contracting officer at Goddard Space Flight Center exercised a launch delay provision and requested that the contractor, Ball Aerospace and Technologies Corporation (Ball), submit an updated cost proposal for completing the GMI. Ball's revised proposal, dated July 24, 2007, stated that NASA's funding constraints had disrupted the original performance plan, causing inefficiencies and time extensions, which Ball projected would result in cost growth of more than 50 percent, about \$■ million. To validate the proposal's reasonableness, the GPM contracting officer requested that the GPM Project Office perform technical and cost reviews. As of February 2008, the Project Office had completed the technical review, but not the cost review.

We believe the funding shortfalls and the ensuing delays have resulted in a dramatic alteration in planning for GPM Project execution, at substantially increased cost. In April 2005, the Chair of the National Academy of Sciences' Committee on Earth Science and Applications from Space: A Community Assessment and Strategy for the Future, warned the House Science Committee that repeated budget cuts threatened many Earth Science programs that are being downsized, delayed, or canceled. NASA's decision to delay GPM to meet other Agency priorities impacted the Project's planning and execution.

The Project's highest ranked risk in July 2007 was securing launch services for the first satellite for the Project, the GPM Core, which will carry the primary precipitation measurement instruments. One of JAXA's roles in the GPM partnership was to provide the launch vehicle for the first satellite; therefore, NASA had not budgeted for a launch vehicle. Because of the GPM Project schedule delays, the planned JAXA launch vehicle was no longer available.

During the course of our audit, it became evident that a successor launch vehicle had not been made available to the GPM Project. As a result, we made several inquiries of various Headquarters officials as to how NASA planned to resolve this matter with JAXA. Subsequently, the Exploration Systems Mission Directorate, the Science Mission Directorate, the Space Operations Mission Directorate, and the Office of External Relations completed and signed an internal Memorandum of Agreement designating a launch vehicle for the first satellite. The designated launch vehicle is from a previously unrelated barter agreement with JAXA connected with the International Space Station (ISS).

In January 2008, NASA and JAXA completed an agreement that provides an H-IIA launch vehicle for the GPM Core. An Implementation Memorandum of Understanding still needed to be completed to specify the launch arrangements. The launch date and arrangements continue to be an area of risk.

Our March 7, 2008, draft of this memorandum recommended that the Goddard Chief Financial Officer, in accordance with Goddard Procedural Requirements (GPR) 5100.5A, "Government Cost Estimates for Acquisitions Exceeding the Micro-Purchase Threshold," April 28, 2005, either conduct an independent assessment of the cost estimate or request a third-party review to validate the estimate.

Management's comments on the draft of this memorandum are responsive (see Enclosure 2). We consider the recommendation resolved and will close the recommendation upon completion and verification of management's action.

Background

NASA and JAXA originally conceived the GPM Project in 2001 as a joint mission to build and expand on the continuing and successful Tropical Rainfall Measuring Mission (TRMM), which monitors and records primarily tropical rainfall. GPM is designed to provide greater capability than TRMM of measuring global precipitation. GPM is expected to provide research scientists the data required to better understand the Earth's water and energy cycle, which should improve climate and weather predictions.

The GPM Project consists of two primary satellites: the Core spacecraft and the Constellation spacecraft. The Core spacecraft, the Constellation spacecraft, and other satellites provided by domestic and international partners will provide data to the NASA Precipitation Processing System (PPS). The Core spacecraft, which NASA will assemble, will carry two primary measurement instruments: the Dual-Frequency Precipitation Radar (DPR) and the GMI. JAXA will provide the DPR, and NASA will provide two GMI instruments (one each for the Core and Constellation spacecraft). The Core spacecraft will also serve as a calibration standard for all of the operational satellites providing data to GPM. The use of a constellation of satellites is designed to enable enhanced data collection and cross-calibration by the PPS.

Under the GPM partnership, JAXA was to provide the Core launch vehicle and services. NASA was to provide instrument integration and ground data collection and processing. NASA and JAXA jointly study the possible contributions of future U.S. and Japanese satellites to GPM. The Constellation spacecraft, which NASA will launch, is one such satellite.

Significant GPM Project Risks

The GPM Project Office had a risk management process that identified, analyzed, tracked, and communicated risks in accordance with NASA Procedural Requirements (NPR) 8000.4, "Risk Management Procedural Requirements," April 25, 2002. The GPM Project used the risk data to categorize and communicate high-risk areas to NASA management in monthly Project Status Reviews. We focused our audit on two risk areas included in the GPM Project Status Reviews and risk reports that we assessed may result

in significant changes to the GPM Project if further delays occur: (1) the prime contract cost growth and (2) the GPM Core launch. NASA was taking steps to identify and mitigate these risks.

Cost Growth of Core's GMI Contract. The GPM Project budget reductions in FYs 2005 through 2007 led to a 2-year delay in the Project's only ongoing prime contract, the development and delivery of the Core's GMI. The Core spacecraft was originally planned to be launched in 2007. Because of budget reductions, the Core launch is now planned for June 2013. In FYs 2005 through 2007, NASA reduced the GPM Project budget to accomplish other goals articulated in the President's Vision for Space Exploration.²

NASA's decision to delay GPM to meet other Agency priorities impacted the Project's planning and execution. In FY 2005, NASA redirected money into implementing the President's Vision, which resulted in funding cuts to NASA's Earth Science programs. These funding cuts raised concerns in the Earth Science community. In April 2005, the Chair of the National Academy of Sciences' Committee on Earth Science and Applications from Space: A Community Assessment and Strategy for the Future, warned the House Science Committee that repeated budget cuts threatened many Earth Science programs that are being downsized, delayed, or canceled.³ This concern was also reflected in the National Research Council's April 2005 interim Decadal Survey report on Earth Science priorities and direction. The interim report recommended that the GPM Project should be launched without further delay. We believe the funding shortfalls and the ensuing delays have resulted in a dramatic alteration in planning for GPM Project execution, at substantially increased cost.

In January 2007, the National Research Council released the final report on its Decadal Survey, which emphasized the importance of the GPM Project and states that the viability of GPM will depend on NASA's commitment to a firm launch schedule. The Decadal Survey includes concerns over launch delays attributed to budget reductions in prior years. Consequently, NASA's Administrator requested additional funding for the GPM Project in the FY 2008 budget in order to keep the mission on schedule.⁴

² On January 14, 2004, President Bush announced "A Renewed Spirit of Discovery: The President's Vision for U.S. Space Exploration" (available online as of February 13, 2008, at http://www.whitehouse.gov/space/renewed_spirit.pdf).

³ The Chair's testimony is available online at <http://gop.science.house.gov/hearings/full05/apr28/Moore.pdf> (accessed February 13, 2008).

⁴ Statement of Michael D. Griffin before the Committee on Science and Technology, U.S. House of Representatives, March 15, 2007 (available online as of February 13, 2008, at <http://legislative.nasa.gov/hearings/3-15-07%20Griffin%20HSTC.pdf>).

The following table shows the changes to the Core launch readiness dates in relation to budget reductions.

GPM Budget and Launch Dates			
Program Operating Plan Year	Budget (dollars in millions)		Estimated Core Launch Date
	FY 2004 President's Budget Submission	Final Approved FY Funding	
FY 2005	\$ 44.2	\$29.1	June 2010
FY 2006	\$ 99.3	\$24.7	December 2012
FY 2007	\$155.9	\$28.8	June 2013
FY 2008	\$143.8	\$89.7	June 2013

The budget reductions lengthened the Project's formulation phase,⁵ which resulted in cost growth. When NASA initiated the GPM Project in 2001, the cost estimate for NASA's contribution to the mission was approximately \$600 million. As of January 2008, NASA's contribution to GPM was estimated at approximately \$1 billion. NASA had budgeted approximately \$196 million for the GPM Project through FY 2008.

In March 2005, Goddard awarded a competitively solicited contract to Ball to build the Core GMI instrument and deliver it in 2009 in order to meet the planned GPM Core launch date of June 2010. At that time, the overall GPM budget provided sufficient funding to initiate and complete the contract. However, in the following fiscal years, GPM Project funding was reduced by NASA to accomplish the goals articulated in the President's Vision, which resulted in a delay of the Core's launch date to June 2013. As a result, NASA delayed the planned GMI delivery date until April 2011, to meet the June 2013 Core launch date. Due to these delays, the GPM contracting officer at Goddard exercised a launch delay provision and requested that the contractor submit a new cost proposal.⁶

Ball's new cost proposal, dated July 24, 2007, showed a \$ [redacted] million cost increase [redacted] of more than 50 percent. Ball attributed approximately \$ [redacted] million of the \$ [redacted] million increase primarily to additional labor costs resulting from the launch delays. [redacted]

⁵ The primary activities in this phase include developing and defining the project requirements and cost/schedule basis and designing a plan for implementation (including an acquisition strategy, contractor selection, and long-lead procurement).

⁶ The GMI contract provides a launch delay clause if NASA directs delays to the launch schedule. The contracting officer may inform the contractor of the revised delivery date and allow the contractor to submit a new proposal.

Ball stated that the cost growth was due to NASA's funding constraints, which disrupted the original performance plan and caused work performance inefficiencies and time extensions for Ball and its subcontractor. We did not evaluate the proposal's cost growth or the increase in labor hours. The results of the GPM Project Office's ongoing cost review will serve to validate the proposal's reasonableness.

The GPM Project could benefit from an independent assessment of the new proposal and could protect NASA from unnecessary costs. To validate the proposal's reasonableness, the GPM contracting officer requested that the GPM Project Office perform technical and cost reviews of the July 2007 proposal. As of February 2008, the Project Office had completed the technical review; the cost review, which required a completed technical review, was still in progress. GPR 5100.5A states that the Goddard Chief Financial Officer has the responsibility to consider whether to make or direct independent reviews to validate a project office's cost estimate. An independent assessment of the cost estimate would provide additional validation of the proposal's reasonableness.⁷

Risks Associated with the GPM Core Launch. The GPM Project's highest ranked risk in July 2007 was the lack of a launch vehicle agreement or commitment for the GPM Core launch. As part of the initial partnership arrangement, JAXA was to provide a launch vehicle. JAXA had intended to include the Core on an H-IIA rocket launch with another JAXA satellite.⁸ Because of this arrangement, NASA did not budget for a Core launch vehicle. However, NASA's budget shortfalls in the GPM Project resulted in schedule delays totaling 6 years as of January 2008, and NASA lost the opportunity to include the Core on that H-IIA rocket launch.

In a February 2006 letter, JAXA suggested that NASA consider using the launch services of an unrelated JAXA H-IIA rocket that had previously been promised to NASA as part of the ISS barter agreement.⁹ In addition, JAXA expressed surprise and disappointment over NASA's announcement of a 2½-year delay to launch GPM Core, which slipped to December 2012. In a January 2007 letter, JAXA noted that NASA had delayed the

⁷ According to the Government Accountability Office's "Cost Assessment Guide: Best Practices for Estimating and Managing Program Costs" (GAO-07-1134SP, July 2007), an independent cost review is one of the best and most reliable validation methods to test a project office's estimate for reasonableness.

⁸ JAXA had originally anticipated launching GPM Core with the Greenhouse Gases Observing Satellite; that launch is currently planned for August 2008.

⁹ The NASA/JAXA barter agreement, executed in September 1997, contains a provision for NASA to provide Shuttle launches to transport and assemble JAXA ISS assets in exchange for JAXA providing other ISS equipment and the future launch services of an H-IIA rocket for a NASA payload.

launch to June 2013, and stated that further delays beyond the June 2013 launch date would cause JAXA to lose its interest in the GPM partnership.

NASA confirmed its commitment to the current launch date of June 2013 in an August 2007 letter to JAXA. The letter from NASA's Associate Administrator for the Science Mission Directorate reaffirmed the importance of the GPM partnership in providing vital global precipitation measurements as described in the Decadal Survey. The letter did not discuss the Core launch issue.

During August 2007, we found that the issue of the launch vehicle had not been resolved and that no action had taken place to obtain the launch services of the H-IIA rocket from the ISS barter agreement. We made several inquiries of various Headquarters officials as to how NASA planned to address the GPM Core launch requirement. On September 10, 2007, the Exploration Systems Mission Directorate, the Science Mission Directorate, the Space Operations Mission Directorate, and the Office of External Relations completed and signed an internal Memorandum of Agreement that makes available to the GPM Project an H-IIA rocket launch derived from the JAXA-promised launch services included in the ISS barter agreement. In January 2008, NASA and JAXA completed an agreement that provides for an H-IIA rocket for the GPM Core launch. NASA and JAXA still needed to complete an Implementation Memorandum of Understanding to specify the launch arrangements.

Although these agreements lessen the risks associated with identifying the Core launch vehicle, the launch date continues to be an area of risk. Any further schedule delays beyond June 2013 caused by NASA could result in JAXA discontinuing its support of the GPM Project.

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

We recommended that the Goddard Chief Financial Officer, in accordance with GPR 5100.5A, either conduct an independent assessment of the cost estimate or request a third-party review to validate the estimate.

Management's Response. The Associate Administrator for Science concurred, stating that the Goddard Chief Financial Officer's Program Analysis Office will perform an independent assessment of the contractor's revised cost estimate for the Core GMI instrument. The projected completion date is June 30, 2008.

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

This version of the memorandum was revised to omit privileged/proprietary commercial and financial information that is exempt from public release under the Freedom of Information Act (Exemption 4).

We appreciate the courtesies extended during our audit. If you have any questions, or need additional information, please contact Mr. Raymond Tolomeo, Science and Aeronautics Research Director, at 202-358-7227 or Mr. Michael Niedringhaus at 202-358-5158.

signed

Evelyn R. Klemstine

2 Enclosures

cc:

Associate Administrator for Exploration Systems

Associate Administrator for Space Operations

Assistant Administrator, External Relations

Scope and Methodology

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

We performed this audit at NASA Headquarters and Goddard. We reviewed NPR 8000.4, NPR 7120.5D, and GPR 5100.5A. We held meetings with GPM Project Office personnel and NASA officials involved with the Project and reviewed the monthly and quarterly status review presentations to gain an understanding of the Project's operation and management structure. In addition, we reviewed the Memorandum of Understanding between NASA and JAXA, "Cooperation of Formulation Activity of the Global Precipitation Measurement Program," June 27, 2005, which defines each party's roles and responsibilities for formulating the GPM Project.

To determine whether the GPM Project Office had procedures and processes in place that effectively identified and mitigated risks of further schedule delays and cost increases, we compared the Project's risk management process with NPR 8000.4 requirements. We also reconciled the identified highest risks for the GPM Project, using the monthly Project Status Reviews (July–December 2007), the August 2007 quarterly Project status presentations, and the Program Operating Plans for FYs 2003–2007.

We met with officials from the Headquarters Office of External Relations and the Space Operations Mission Directorate to discuss planned negotiations involving GPM and the JAXA-provided launch vehicle. We also interviewed GPM Project management and the GPM contracting officer concerning their processes for review and oversight of the July 2007 cost proposal that NASA requested from Ball and concerning future monitoring efforts over the contract costs and performance. We reviewed the contract files for the GMI effort, including the pre-award files.

Computer-Processed Data. We did not use computer-processed data to perform this audit.

Review of Internal Controls. We determined that the GPM Project Office risk management process met NPR 8000.4 requirements, and we did not identify any internal control weaknesses.

Prior Coverage. During the last 5 years, the NASA OIG has issued one report of particular relevance to the GPM Project: "NASA Can Improve Its Mitigation of Risks Associated with International Agreements with Japan for Science Projects" (IG-06-020, September 12, 2006). Unrestricted reports can be accessed over the Internet at <http://oig.nasa.gov/audits/reports/FY08/index.html>.

Management's Comments

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



Reply to Attn of:

SMD/Earth Science Division

TO: Assistant Inspector General for Auditing
FROM: Associate Administrator for Science Mission Directorate
SUBJECT: Draft Memorandum on Audit of NASA's Global Precipitation
Measurement Project (Assignment No. A-07-014-00)

Thank you for the opportunity to review and comment on the subject draft memorandum. We appreciate the suggestions provided by the auditors during the course of the audit including those that were not incorporated as recommendations.

Our specific comments to the recommendation contained in the draft memorandum follow.

OIG Recommendation

We recommend that the Goddard Chief Financial Officer, in accordance with GPR 5100.5A, either conduct an independent assessment of the cost estimate or request a third-party review to validate the estimate.

NASA Management Response

Concur. The Goddard Chief Financial Officer's Program Analysis Office will perform an independent assessment of Ball's revised cost estimate for the Core GMI instrument. The projected completion date is June 30, 2008.

Please contact Steven Neeck at 358-0832 if you have further questions or need further coordination in this matter.

A handwritten signature in black ink, appearing to read "S. Alan Stern".

S. Alan Stern

cc:
SMD/Mr. Gay
SMD/Mr. May

SMD/Dr. Freilich
SMD/Mr. Luther
SMD/Dr. Volz
SMD/Mr. Neeck
ICMS/Mr. Becker
ESMD/Dr. Gilbrech
SOMD/Mr. Gerstenmaier
OER/Mr. O'Brien
GSFC/Dr. Weiler
GSFC/Dr. Ejjasa