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Description of document: National Aeronautics and Space Administration (NASA) Report Regarding Program and Cost Assessment and Control Assessment Pursuant to Section 1203(b)(l) of the NASA Authorization Act of 2010 (P.L. 111~267), December 2010 Request date: 23-November-2014 Released date: 19-December-2014 Posted date: 20-April-2015 Source of document: Freedom of Information Act Request NASA Headquarters 300 E Street, SW Room 5Q16 Washington, DC 20546 (202) 358-4332 Fax: Email: foia@hq.nasa.gov

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National Aeronautics and Space Administration

Headquarters Washington, DC 20546-0001



December 19, 2014

Reply to Attn of: Office of Communication

REF: 15-HQ-F-00151 (formerly 15-GSFC-F-00144)

Thank you for your Freedom of Information Act (FOIA) request dated November 23, 2014. Your request was transferred from the Goddard Space Flight Center (GSFC) and received December 4, 2014 at the NASA Headquarters FOIA Office. Your request was assigned FOIA Case Number 15-HQ-F-00151was for:

the most recent Report on Program and Cost Assessment and control Assessment, prepared under Public Law 111-267, Section 1203.

On November 25, 2014, you clarified your request:

SEC. 1203. REPORTS ON PROGRAM AND COST ASSESSMENT AND CONTROL ASSESSMENT.

- (a) FINDINGS. ?Congress makes the following findings:
- The adherence of NASA to program cost and schedule targets and discipline across NASA programs remains a concern.
 42 USC 18442.
 42 USC 18441.
- (2) The James Webb Telescope has exceeded its cost estimate.
- (3) In 2007 the Government Accountability Office issued a report on NASA?s high risk acquisition performance.
- (4) In response, NASA prepared a corrective action plan two years ago.
- (b) REPORTS.?

- (1) REPORTS REQUIRED.?Not later than 90 days after the date of the enactment of this Act, and not later than April 30 of each year thereafter, the Administrator shall submit to the appropriate committees of Congress a report on the implementation during the preceding year for the corrective action plan referred to in subsection (a)(4).
- (2) ELEMENTS.?Each report under this subsection shall set forth, for the year covered by such report, the following:
- (A) A description of each NASA program that has exceeded its cost baseline by 15 percent or more or is more than 2 years behind its projected development schedule.
- (B) For each program specified under the subparagraph (A), a plan for such decrease in scope or requirements, or other measures, to be undertaken pursuant to the National Aeronautics and Space Administration Authorization Act of 2005 (Public Law 109?155), and the amendments made by that Act.

The NASA Headquarters program office(s) conducted a search for Agency records. We have identified a document consisting of 31 pages was in response to your request. This document is being released in full.

Fees for processing this request are less than \$50.00 and are not being charged in accordance with 14 CFR §1206.504(f).

We apologize for the confusion in determining the location of this document resulting in the assignation of different FOIA Case File Numbers.

Please contact Martha Terry at <u>hq-foia@nasa.gov</u> or at 202-358-2339 if you require further assistance.

Sincerely, Josephine Sibley Headquarters, FOIA Officer



Report Regarding Program and Cost Assessment and Control Assessment

Pursuant to Section 1203(b)(1) of the NASA Authorization Act of 2010 (P.L. 111-267)

December 2010

BACKGROUND

This report is pursuant to direction included in the National Aeronautics and Space Administration Authorization Act of 2010 (P.L. 111-267), specifically section 1203(b)(1) and section 1203(b)(2). Section 1203(b)(1) requires that:

"Not later than 90 days after the date of the enactment of this Act, and not later than April 30 of each year thereafter, the Administrator shall submit to the appropriate committees of Congress a report on the implementation during the preceding year for the corrective action plan referred to in subsection (a)(4)...

Section 1203(b)(2) requires that:

"Each report under this subsection shall set forth, for the year covered, by such report, the following:

- (.1) A description of each NASA program that has exceeded its cost baseline by 15 percent or more or is more than 2 years behind its projected development schedule.
- (B) For each program specified under subparagraph (A), a plan for such decrease in scope or requirements, or other measures, to be undertaken to control cost and schedule, including any cost monitoring or corrective actions undertaken pursuant to the National Aeronautics and Space Administration Authorization Act of 2005 (P.L. 109-155), and the amendments made by that Act.

EXECUTIVE SUMMARY

NASA created its High Risk Corrective Action Plan (CAP) in October 2007. To date, five of the plan's seven initiatives are complete and operational; one is partially operational and the remaining initiative is being reworked to reflect lessons learned since the CAP was produced three years ago. Table 1, below, summarizes the implementation of these policies (and precursor efforts).

The recent report of the James Webb Space Telescope Independent Comprehensive Review Panel (ICRP) provides additional recommendations for how NASA could improve in some of these areas. NASA is working on its response to the ICRP report, and should that response affect the policies and actions described in this report NASA will provide the Congress with an amended version.

Five projects—Aquarius, Glory, James Webb Space Telescope (JWST), National Polar-Orbiting Operational Environmental Satellite System (NPOESS) Preparatory Program (NPP), and Stratospheric Observatory for Infrared Astronomy (SOFIA)—have either exceeded their baseline development- cost by 15 percent, or are more than six months¹ behind their baseline-development schedule.² Four of these projects (Aquarius, Glory, NPP, and SOFIA) were base-lined prior to the corrective actions initiated in October 2007. The remaining project, JWST, was baselined too early in the CAP process to benefit from one of the key corrective actions—the use of joint probabilistic cost and schedule estimation. Table 2, below, illustrates the application of selected policy changes to individual NASA projects, including the projects addressed in Part 2 of this report.

¹ Although Sec 1203 specifies reporting on project corrective action plans for projects which have exceed their development schedule by 2 years, this report is including all projects with development schedule growth of 6 months or more for consistency with reporting requirements under Sec 103 NASA Authorization Act of 2005 (Public Law 109-155).

² Some NASA projects have experienced an increase in their cost estimate during formulation, before the project baseline is established, but after significant funding has been committed. This is a serious concern that the agency is addressing. Changes in cost estimates during formulation reflect the increasing understanding of project requirements as they mature.

This report is divided into two parts. Part 1 addresses Sec 1203(b)(1) on the implementation of NASA's CAP addressing high risks identified by the Government Accountability Office in acquisition performance. Part 2 addresses Sec 1203(b)(2) by providing a description of four projects (Aquarius, Glory, NPP, and SOFIA) that have exceeded their baseline development cost by 15 percent or their baseline development schedule by 6 months, along with summaries of corrective actions being undertaken by these projects. Additional information for JWST will be provided as corrective actions are finalized.

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Table 2: Recent History of Using Confidence or Joint Cost and Schedule Confidence Levels

1.0 NASA'S CORRECTIVE ACTION PLAN STATUS REPORT

Over the last three years, NASA has fundamentally transformed how it manages its programs and projects, acquisition strategies, and procurements. NASA has strengthened program and project management (Initiative A); elevated acquisition decisions to NASA's highest levels (Initiative B); instituted targeted enhancements to project-management training (Initiative D); established more rigorous cost estimation practices (Initiative E); entirely revamped enterprise architecture for the Agency's acquisition systems (Initiative F); and revised procurement practices and systems (Initiative G).

Initiative	Title	Status
Α	Program/Project Requirements and Implementation Practices	Operational
В	Agency Strategic Acquisition Approach Operations	
С	Contractor Cost Performance Monitoring In Pro	
D	Project Management Training and Development	Operational
E	Improve Life-Cycle Cost/Schedule Management Processes	Partially Operational
F	IEMP Process Improvement	Operational

G	Procurement Processes and Policies	Operational
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In 2009, GAO complimented NASA on the 'important advances' it had made in implementing the CAP initiatives. NASA believes that the preceding year's advances substantially address all five of the criteria for being removed from the High Risk list:

- Leadership: NASA simultaneously made fundamental and coordinated changes in its acquisition, budgeting, financial systems, and program & project management policies and processes. Changes of this magnitude and significance cannot be made without the active and persistent leadership of an Agency's management. The CAP is managed by the Deputy Administrator, and individual initiatives are owned by the Chief Engineer, the Chief Financial Officer, the Chief Information Officer, the Associate Administrator for Independent Program and Cost Evaluation, and the Assistant Administrator for Procurement. The Baseline Performance Reviews (BPR) is chaired by the Associate Administrator. This dedication has been sustained through two Administrations.
- **Capacity:** NASA has built the capacity necessary to sustain each operational initiative. Significant new investments in program and project training ensure that changes in policy are reflected in practice in the field. The institutionalization of monthly BPR brings together NASA's senior management from across the Agency to review performance on a monthly basis.
- **CAP:** The CAP adopted by NASA in October 2007 has been aggressively implemented with only one significant initiative re-direction (Initiative C addressing contract cost performance monitoring) made in order to take account of lessons learned in the course of implementing other information technology systems provided for in the CAP.
- Effectiveness: Monitoring & independent validation of the effectiveness of the changes NASA has made to the way it does business is accomplished in various ways. The BPR provide monthly assessments of program and project performance throughout project lifecycles. Detailed independent assessments are made by the NASA Office of Independent Program and Cost Evaluation (IPCE) in conjunction with lifecycle reviews and the Office of the Chief Financial Officer (OCFO) documents any changes in project costs or schedules from approved cost and schedule baselines. In order to gauge the overall effectiveness of the CAP initiative, NASA is tracking the cost and schedule performance for project baselines after CAP initiatives began to take effect compared to performance for projects approved previously. Updates are provided on a semi-annual basis.
- **Demonstrate progress:** All of the milestones for five of seven CAP initiatives have been completed, and their resulting improvements are operational. As a result of these improvements, acquisition decisions are being made earlier in project formulation; project authority-to-proceed into implementation is based on a more rigorous representation of cost and schedule; program and project management training has grown; cost and schedule changes from baseline are being rigorously tracked; and procurement award fee, Earned Value Management (EVM) and other policy improvements are in place.

Projects approved for development in 2010 have benefitted more from these initiatives than did projects approved in 2008 or even 2009 as NASA has 'learned by doing.' Because NASA's projects spend more than a year or two in development, the long-term improvements to NASA's project

performance should become increasingly evident. Nonetheless, evidence of improved performance is available:

- Overall, the growth in development costs for the 8 projects in development since mid 2008 (the basis for the High Risk metrics) has been just 2 percent. While there will undoubtedly be some additional cost growth for these projects, especially for those projects confirmed before the joint cost and schedule estimation processes were fully put in place, this 'good start' reflects the policy and process changes outlined in this report.
- Technical difficulties encountered by the Juno program have been within the additional resources provided the Juno project at Key Decision Point (KDP)-C in order to ensure a 70 percent joint cost and schedule confidence level.
- Landsat Data Continuity Mission (LDCM) was able to accommodate Congressional direction to add an additional instrument as it entered development, with only a 1 percent growth in cost in its first ½ year of development.
- Magnetospheric MultiScale (MMS) and Tracking and Data Relay Satellite (TDRS) K-L have completed a year of development with no change in its estimated cost, while Radiation Belt Storm Probes (RBSP) has completed a year and one-half of development with no change in estimated cost.

An additional word about the one initiative that is still in development is in order. The CAP initiatives have not been inexpensive; in fact, one initiative (Integrated Enterprise Management Program [IEMP]) constituted a Major Development Project for purposes of cost and required a Major Program Annual Reports (MPAR) to Congress. Over the prior two years, NASA has learned a great deal about how to assess the cost-effectiveness of implementing system-wide changes, including IT changes. As IT costs have grown, NASA believes it is prudent to re-consider how to best support program and project management use of contractor performance data under Initiative C, and especially to identify any options that would be less costly than a major change to SAP, the Agency's financial system. This initiative will still accomplish, when put into place, an automated link for project managers between project costs represented in the Agency's SAP financial system, and contractor costs, represented in contractor reporting.

1.1 INITIATIVE A1: Revise and Implement Program/Project Management Requirements

Lead Executive:

Michael G. Ryschkewitsch, Chief Engineer

Overall Status:

Initiative A1 has been completed and is operational.

Milestones:

All Initiative A1 milestones have been completed.

Status	Milestone
Completed	Issue NPR 7120.5D, NASA Space Flight Program and Project Management Requirements
Completed	Rollout NPR 7120.5D policy to JSC, LaRC, and MSFC
Completed	Issue Mission Directorate and Center NPR 7120.5D implementation evaluation criteria
Completed	Issue NPR 7120.8, NASA Research and Technology Project Management Requirements

Completed	Issue NPR 7120.7, NASA Institutional Infrastructure and Information Technology Program and
_	Project Management Requirements
Completed	Rollout NPR 7120.5D policy to ARC, DFRC, GRC, and JPL
Completed	Rollout NPR 7120.5D policy to HQ and three remaining Centers (KSC, SSC, GSFC)
Completed	Mission Directorate and Center visits and survey their implementation of NPR 7120.5D

Metrics:

At each initial Mission Directorate and Center visit, the Office of Chief Engineer (OCE) will develop and document a baseline of compliance to NASA Procedural Requirement (NPR) 7120.5D (NASA Space Flight Program and Project Management Requirements). Gaps will be identified, and mitigation plans will be required with the goal of reducing and ultimately eliminating the gaps. On future visits, the number of gaps at each Center will be noted, and this metric will be used to identify trends over time. OCE will provide this information to the Office of Procedural and Institutional Integration (OPII) for the purpose of monitoring progress against this plan. Appropriate baselines and targets will be identified as this activity progresses.

Results: In the 2008-2009 surveys, there was one non-compliance to NPR 7120.5D, and a waiver was worked by that Center to address the low-risk item. There were some non-compliances identified in the Software area (against NPR 7150.2). CAPs are required to address those findings, and all responses to the non-compliances have been completed or are being worked. Results were provided to all offices involved in implementing this CAP, including the OPII office integrated into the Mission Support Directorate.

Operational Status:

The NPRs completed as a part of this initiative are operational. NPRs are updated as needed. For example, a NASA Interim Directive (NID) was issued September 2009, and will be followed by a fully updated 7120.5D version E in 2011.

Center implementation surveys are operating on an approximately a two-year cycle, with the next surveys starting in October 2010. In addition to NPR 7120.5D (NASA Space Flight Program and Project Management Requirements), NPR 7150.2 (NASA Software Engineering Requirements), NPR 7120.8 (NASA Research and Technology Program and Project Management Requirements) and NPR 7123.1A (NASA Systems Engineering Processes and Requirements), NPR 7120.6 (Lessons Learned Process), NDP 8070.6 (Technical Standards) have also been included in the survey scope and will continue to be included in the second round of surveys

1.2 <u>INITIATIVE A2: Improve Management Oversight of Project Cost, Schedule, and</u> <u>Technical Performance-State of the Agency Reporting</u>

Lead Executive:

Michael G. Ryschkewitsch, Chief Engineer

Overall Status:

Initiative A2 has been completed and is operational.

Milestones:

All Initiative A2 milestones have been completed.

Status	Milestone
Completed	State of the Agency process chartered by Program Management Council (PMC)
Completed	Evaluation criteria established and first program/project review held

Metrics:

The specific target for this metric is zero instances in which a project breaches internal NASA cost and/or schedule thresholds without having predicted such breach and without having previously highlighted such prediction to senior management during the BPR. *"From October 2007 through August 2010, BPR project independent assessments were rated yellow or red in the 3 months prior to the first project-reported growth in development cost from baseline."* Actions are assigned to the Mission Directorates and projects to present a risk mitigation plan. The BPR project assessment for the criteria for "green" is based on the projects ability to solve issues with the project's planned resources. The project assessment for the criteria for "yellow" indicates a threat to the project's ability to meet their commitments within the project's planned resources. The project assessment for the criteria for "red", it is estimated that the project will not have sufficient resources to meet its commitments. Examples of the criteria universally applied to each project assessed include the following:

- Green Schedule Schedule progress remains consistent with schedule commitments: funded schedule reserves and phasing are consistent with plan; key milestones are being met; and external partners are providing key deliverables.
- Yellow Schedule In general, the program or project follows the green assessment guidelines, but schedule commitments are now threatened. Remaining schedule margin appears inadequate to meet requirements; Schedule reserves are being drawn down faster than planned; External partners are delayed in providing key deliverables.
- Red Schedule The Program or Project is estimated not to meet its schedule commitments without significant impact to other categories. Schedule reserves are being drawn down at an unsustainable rate; a slip of one or more key interim milestones is inconsistent with plan; and an external partner delays or delays caused by other external factors.

Operational Status:

- Baseline Performance Reviews (previously State of the Agency) have been held monthly since June 2006.
- The process has been significantly enhanced over the four years since then and a review of the BPR content is underway presently.
- Rating criteria based on the ability of the program or project to perform to plan have been adopted and provide the basis for the independent assessment team's reviews.
- Programs and projects are reviewed monthly, with quarterly in-depth reviews. Programs or projects rated 'red' receive additional evaluation at the BPR.

- Cross cutting technical and non-technical issues are identified and tracked and an Agencylevel risk identification process is under development.
- Specific mission support functions such as procurement, safety and mission assurance, institutional mission support, and funds execution are reviewed monthly.
- Any Center-specific programmatic and institutional issues are reviewed monthly.
- Special topics are included on an as-needed basis.

1.3 INITIATIVE B: Agency Strategic Acquisition Approach

Lead Executive:

Richard Keegan, Deputy Associate Administrator, Mission Support Directorate

Overall Status:

Initiative B has been completed and is operational.

Milestones:

All Initiative B milestones have been completed.

Status	Milestone	
Completed	NASA FAR Supplement, Procurement Notice 04-16, "Acquisition Planning Changes:	
_	Procurement Strategy	
Completed	NPR 7120.5D, Space Flight Program and Project Management Requirements (as	
	noted under Initiative A1)	
Completed	Acquisition Strategy Planning (ASP) held addressing Agency Information	
	Technology Strategy	
Completed	Procurement Strategy Management (PSM) held on Tracking & Data Relay Satellite	
	System	
Completed	PSMs held Ares V Core Stage RS-68B Engine, Ares I Instrument Unit Production	
	Acquisitions	
Completed	ASP held on Agency mission portfolio, with emphasis on workforce.	
Completed	Hold another ASP, document lessons learned, take any necessary actions.	
Completed	Hold another ASM, document lessons learned, take any necessary actions	
Completed	Revise applicable policy, 7120 series.	

Metrics

The Initiative B goal is to integrate individual program/project planning with higher level Agency strategies and commitments and factor ASP and ASM decisions into budget process & program/project planning. ASP/ASM summary records are to be documented within 120 days of each ASP & ASM, and a synopsis of results is to be provided to the Deputy Administrator semiannually.

ASPs and ASMs became a required part of program and project lifecycles in December 2007. Communication with NASA senior leadership(including the Administrator and Deputy Administrator), and budget coordination, is provided for in part through a broad ASP review held annually, or more frequently at the Administrator's discretion, to evaluate the entire Agency mission portfolio from an acquisition strategy perspective. Results of this ASP (as well as individual program and project ASPs and ASMs) are factored into senior management budget deliberations at least twice during the annual budget cycle: in preparation for approving the budget planning guidance; and in making final decisions on the Agency's budget submission to OMB. Responsibility for managing and documenting ASMs and ASPs has transferred with the Office of Program Institutional Integration (OPII) to the newly established Mission Support Directorate (MSD), bringing better coordination of acquisition-strategy decisions and Agency workforce and infrastructure requirements.

Operational Status:

Four policy changes have standardized ASPs and ASMs as part of NASA's way of doing business. NASA's Governance and Strategic Management Handbook, NDP 1000.0A, provides for a strategic approach to acquisition management and provides the governance framework for these decisions. NASA's new Acquisition Policy (NPD 1000.5A) created an Agency acquisition policy which requires major acquisitions to be reviewed at the senior Agency management level in order to allow an Agency-wide, strategic approach to making acquisition decisions. The changes to 7120.5 and 7120.8 ensure that program and project managers are responsible for obtaining Agency acquisition direction before advancing to Phase B of formulation.

Policy	Effective Date	Title
NPD 1000.0A	Aug 1, 2008	NASA Governance and Strategic Management Handbook
NPD 1000.5A	Jan 15, 2009	Policy for NASA Acquisition
NPR 7120.5D NID	Sept 22, 2009	NM 7120-81, NASA Interim Directive (NID) for NASA Procedural Requirements (NPR) 7120.5D, NASA Space Flight Program and Project Management Requirements
NPR 7120.8	Feb 5, 2008	NASA Research and Technology Program and Project Management Requirements

• Agency senior management is informed monthly of all upcoming ASMs and ASPs. In order to continuously improve the process, MSD consults with senior management (the Associate Administrator) on a regular basis to fine-tune meeting topics and arrangements. MSD guides the agenda, manages the attendance, and co-signs the meeting minutes.

The following examples of ASMs held during 2010 provide a flavor of the range of influence this initiative is having on the Agency.

Item	Month- Year	Acquisition Strategy Planning (ASP) Meetings and Acquisition Strategy Meetings (ASMs)	Sponsoring Organization
1	Feb-10	ASM held for Ice, Cloud, and land Elevation Satellite-2 (ICESat-2)	Science Mission Directorate (SMD)
2	Mar-10	ASM held for Orbiting Carbon Observatory-2 (OCO-2)	SMD
3	Apr-10	ASM held regarding Cooperative Agreement for a Non- Profit Organization to Develop and Manage Select Uses of the International Space Station	Space Operations Mission Directorate (SOMD)
4	Jul-10	ASP held regarding Office of the Chief Technologist's Space Technology Programs	Office of the Chief Technologist (OCT)

1.4 INITIATIVE C: Contractor Cost Performance Monitoring

Lead Executive:

Beth Robinson, Chief Financial Officer

Overall Status:

Initiative C is in process. The strategy for completing this initiative has changed as a result of the business case analysis undertaken recently. The status information below reflects these changes. The goals for this initiative have not changed.

Milestones:

The milestones for this initiative will be updated to reflect the changes in plan described below.

Status	Milestone		
Completed	Team leader appointed by Office of Chief Engineer.		
Completed	Team membership confirmed and first meeting held.		
Completed	Team establishes charter and scope document		
Completed	Team establishes detailed plan		
Completed	Team holds midterm progress review		
Completed	Team completes recommendations for re-engineered contract cost reporting process.		
M/BSIG	Recommendations analyzed by technical, legal, procurement, and M/BSIG; most		
briefed;	practical solutions have been identified.		
new			
approach			
established			

Metrics:

New metrics will be determined as part of Phase 3 of this revised initiative (see below).

Operational Status:

NASA's program and project managers obtain actual costs from NASA's financial system. Contract cost and performance details are obtained from contract reports, including Form 533 reports and Earned Value Management (EVM) reports. Programs and project incorporate contractor cost and EVM information into monthly status reports as a part of the information used to explain overall project performance, identify potential cost or schedule issues, and inform estimates of project cost at completion. An electronic version of Form 533 is now available, which facilitates incorporation of this information into contractor and project cost analysis.

Development Status:

NASA believes that IT tools can assist program and project managers in more effectively and efficiently incorporating contract cost information into contractor and project performance assessments, and is committed to developing a more robust contract cost assessment tool suite or enhancing current Agency tools as applicable.

The Contractor Cost Performance Monitoring Initiative (CCPMI) was established in October 2007 as part of Initiative C of the Corrective Action Plan. As a result of synergies between this initiative and Initiative F1 on business system gap analysis, CCPMI was transitioned into the Contractor Performance and Cost Tracking Initiative (CPACT). The CPACT business case was presented to the Management/Business Systems Integration Group (M/BSIG) in March 2010; however, the M/BSIG was reluctant to commit immediately to the full project scope. Lessons learned with respect to the limitations and growing costs of IT systems indicate the importance of ensuring that the resultant contract cost management tools are as cost-effective as possible. While the business case attempted to address potential costs and benefits over a period of time (FY11-FY22), the M/BSIG recommended that the high level requirements be revalidated and that a project team begin formulation activities for an integrated solution. The high level requirements were revalidated in April 2010. The project team is to report to the M/BSIG, IT Strategy and Investment Board (IT SIB) and Mission Support Council (MSC) with its conclusions and recommendations.

In May 2010, the responsibility for the High Risk List activities was transferred from the Office of Program Institutional Integration (OPII) to the Office of the Chief Financial Officer (OCFO). The OCFO has taken initial steps to revalidate the needs of the various Agency stakeholders, identify potential gaps, and better understand the data that is currently being collected. Groundwork to support these efforts began this summer including, but not limited to: review of existing Agency tools regarding capabilities and current practices; discussions with stakeholder communities across the Agency to gather and leverage current best practices; and garnering participants from each community to re-engineer the process and strengthen the relationships between the stakeholders. The OCFO is in the process of assembling a Project Team, as recommended by the M/BSIG, to undertake this effort.

The goal of this effort—to ensure that needed data elements are available for effective contract management, performance monitoring, and Agency financial management—has not changed. The Chief Financial Officer (CFO) has established a phased approach to defining and implementing a set of strategies which will strengthen the processes used by NASA to perform these functions:

Phase I: Establish formulation team and develop methods to address data and analysis needs Phase II: Pilot Exercise Phase III: Implementation

As part of this effort, OCFO plans to determine the appropriate recording and reporting levels needed by all communities (Finance, Procurement, and Project) to record obligations and costs while capturing cost/schedule integration data at lower levels. Existing tools, such as NASA's electronic Contract Cost Report, will be leveraged where possible in order to minimize development cost and smooth implementation. NASA policy will be modified, if necessary, to reflect the resulting data systems. Although project-level EVM (including in-house as well as contractor EVM results) is not part of the High Risk Corrective Action Plan, Initiative C will reflect the insights developed in the EVM Capability Project pilots currently being undertaken through a separate effort to the extent they are applicable to the Initiative's focus on contractor cost data.

During interviews with the respective stakeholder communities for this initiative, the need for NASA to improve its communications among the various stakeholder communities was evident. Part of the Implementation Phase will include a communication plan. This plan will address the resulting policy changes and the way stakeholder communities share information. It will illustrate the interdependence of cost activities among the communities and how vital the understanding of that is for the successful integration of NASA's contractor cost and performance tracking. NASA will

continue to identify areas requiring training in new, as well as existing, policy and procedures as this Project progresses.

1.5 INITIATIVE D: Project Management Training and Development

Lead Executive:

Michael G. Ryschkewitsch, Chief Engineer

Overall Status:

Initiative D has been completed and is operational.

Milestones:

Three of the four milestones have been completed. Due to the greater-than-expected response to the training enhancements established to date, the final milestone, development of a new Executive Program, has been revised since the intent of this milestone has been addressed through other venues including Master's Forums.

Status	Milestone
Completed	PMC & Program/Project Management Board briefing on Core Curriculum & In-
	Depth Courses
Completed	Publish requests to share engineering & project management knowledge and best
	practices. (Accomplished through ASK Magazine published 3-4 times a year.)
Completed	Establish Technical Leadership Institute (TLI) to provide Agency recognition
	(certification) for professional development of program & project managers.
Revised	Complete development of new Executive Program course materials (see operational
approach	discussion, below).
completed	

Metrics:

Participation in enhanced/expanded training opportunities has greatly exceeded the CAP targets, as follows:

- 15 percent increase in total Core Curriculum and In-Depth Course participants. This metric was met, and exceeded in only one year (2008), with a 52 percent increase in total participants during FY2008 compared with the FY2007 base.
- Identify project team-member training deficiencies and prepare a schedule of training offerings by April 2008. This metric was met with the Training Needs Analysis conducted in FY 2008, resulting in the Academy of Program, Project & Engineering Leadership (APPEL) adding an additional course, the Acquisition/Contracting Workshop, to the 10 courses developed since 2007.
- Senior management emphasis on project and contract management was demonstrated as follows:

Metric	FY2008 Target	FY 2008 Actual
ASK Magazine stories per year	2	4 articles & 3 issues

Case Studies	1	2
ASK OCE (ASK the Academy)	4	4
APPEL Website/NEN	6	All have been published on
		line

 For the Masters Forum, an increase from 91 in FY 2007 to 100 in FY 2008. Knowledge Sharing Masters Forum participation reached a total of 186 civil servants participating in FY 2009, when 3 Forums were held.

Operational Status:

Demand for APPEL and other program and project-management training, including senior level training, continues to exceed expectations. NASA also continues to customize its learning activities to meet project team, Center or Directorate needs. For example, a special training session on Beyond Earned Value Management Basics was provided to members of the Science Mission Directorate. In addition to the CAP training initiative, NASA has certified individual program and project managers in response to OMB's Federal Acquisition Certification (FAC) for Program/Project Managers (P/PMs) requirements.

The large demand for program and project training courses of all kinds has required NASA to adjust training resources. The need for the planned Executive Program has been addressed by other offerings, such as Masters Forums. Indeed, in addition to the 67 managers required by OMB to receive project management certification, NASA has certified additional program and project officials, creating a robust management pipeline for the Agency.

Civil servant registration for Core Curriculum and In-Depth Courses remain well above plan, as follows:

Training Type	FY2007 (Base)	Goal	FY2008 actual	FY2009 actual	FY2010 (through August 5)
Core & Advanced Courses	814	939	1236	1271	1361
PM Challenge			564	682	747
Masters Forum		100		186 @ 3	117
				Forums	

1.6 INITIATIVE E1: Improved Cost Estimation

Lead Executive:

Michael Hawes, Associate Administrator for Independent Program and Cost Evaluation.

Overall Status:

Initiative E1 is nearly complete, with the key joint cost and schedule confidence level (JCL) stood up as an Agency requirement supported by on-going training for projects as they embark on JCL analyses.

Milestones:

Status	Milestone
Completed	Update to NPR 8000.4 Risk Management Procedural Requirements
Completed	NPR 7120.5D, Program/Project Management to finalize 70 percent confidence requirement
Completed	Incorporate confidence level requirements into budget formulation guidance
Completed	Conduct cost community workshops to identify weaknesses in existing cost and schedule estimation models and tools
Completed	Finalize training plan for probabilistic cost estimation
Completed	Cost-analysis symposium & one-day cost & schedule growth summit to identify reasons for cost & schedule growth.
Completed	Incorporate new cost estimation policies into NASA risk management and project management policy documents.
Completed	Train cost-estimating community on probabilistic cost estimation.
Completed	Complete and test new probabilistic cost risk management tools

Metrics:

Projects are authorized to proceed into phases B or C with a credible probabilistic life-cycle cost estimate and which do not possess cost or schedule growth characteristics. NASA's cost estimation policies and practices have evolved since the CAP was adopted to require projects to generate resource-loaded schedules and develop a joint cost and schedule confidence estimate (JCL) at Key Decision Point C (KDP-C), to be evaluated by an independent entity (e.g. a Standing Review Board). NASA is tracking the number of projects, by year that passes the KDP-C milestone with a completed and independently reviewed JCL estimate. Because cost estimates are begun well prior to the approval date, projects approaching KDP-C at the time of this policy change (January 2009) could not necessarily incorporate the new policy before their KDP-C date. Two of the three projects authorized to proceed into phase C during 2009 were able to incorporate the additional schedule component required for a JCL estimate. As of 2010, all projects authorized to proceed into phase C had a completed and reviewed JCL at their KDP-C milestone.

NASA also undertook two pilot JCLs for projects approaching KDP-B and based on the results of these pilots, is modifying its policy for this earlier stage in the project's lifecycle. Probabilistic estimates will be utilized to establish cost and schedule ranges for KDP-B

2008		2009		2010		
Confirmed	Completed &	Confirmed	Completed &	Confirmed	Completed &	
at KDP-C	independently	at KDP-C	independently	at KDP-C	independently	
	assessed JCL		assessed JCL		assessed JCL	
	at KDP-C		at KDP-C		at KDP-C	
JWST	N/A	GPM	MMS	LADEE	LADEE	
Juno	(JCL policy	GRAIL	LDCM	MAVEN	MAVEN	
RBSP	established	MMS		IRIS	IRIS	
	after cost	LDCM				
	estimates for	TDRS				
	these projects					
	were					
	developed)					

Operational Status:

NASA has completed the introduction of, and training in, the probabilistic cost estimating techniques provided for in this initiative. Given the limitations of a cost-only approach to probabilistic cost estimation, however, NASA decided to require a joint cost and schedule probabilistic analysis (JCL) as part of its new NDP 1000.5 Acquisition Strategy policy adopted in January 2009. This more advanced approach fully integrates technical, cost, and schedule plans and risk, providing a more robust basis of estimate. As of August 2010, 12 projects at or beyond the commitment key decision point (KDP C) have completed joint confidence level calculations, two projects have joint confidence level calculations in process, and another two projects nearing their KDP C are currently in planning for FY 2011 completion of a joint confidence level calculation.

The introduction of a JCL approach puts NASA on the leading edge of applying these techniques developed by the private sector to address commercial production—in both the Federal and space sectors. The pace of NASA's adaptation of this more advanced technique has been set in part on the need to adapt these cost analysis techniques to the one-of-a-kind development efforts undertaken by NASA. Through 2009 and 2010, NASA continued to refine and deploy the techniques being utilized.

Because these advanced estimating approaches require the employment of new tools and techniques, some of which are still in development, NASA will continue to support tool development and to provide its projects with training and analytical support in utilizing enhanced tools. NASA's current approach of having projects generate these analyses results in the development of better plans because they must explicitly quantify their risks and integrate those risks into their development costs and schedules. Further, these plans are being reviewed by an independent entity – a Standing Review Board (SRB) in conjunction with IPCE's Independent Program Assessment Office (IPAO).

Given the typical project development cycle of 3-5 years, it is unlikely that the Agency will be able to evaluate the impact of these changes for a few more years.

1.7 INITIATIVE E2: Improved Data Collection: Reporting CADRe

Lead Executive:

Michael Hawes, Associate Administrator for IPCE.

Overall Status:

Initiative E2 partially is operational

Milestones:

Status	Milestone
Completed	Complete 50 Cost Analysis Data Requirements (CADRes)
Completed	Agreed upon standard CADRe template for manned missions.
Incomplete	Develop One NASA Cost Engineering database (ONCE) training course
In progress	Complete & deploy web-based ONCE to made CADRes widely available
Completed	Develop procedures to verify when project cost estimates at starts KDP-D and E
	exceed 15 percent baseline thresholds.
Completed	Complete 100 CADRes (cumulative)
In progress,	Complete 150 CADRes (cumulative)

with 125
completed

Metrics:

Upon implementation of CADRe through the milestones identified in this initiative, a survey will be conducted to measure the percent of cost-estimating users who think the CADRe data meet their estimating needs. IPCE will manage this survey and will provide results and analysis to OPII for the purpose of monitoring progress against this Plan. Target scores are not yet identified. The survey is planned for completion in summer 2008.

Operational Status:

The development of CADRes has become a standard part of the 7120.5 process accompanying each lifecycle review. For missions that have launched, all completed CADRes are available to cost and program analysts on a document management database and will be transferred to the ONCE data management system, for which preliminary development has been completed. The templates are stable and provide project technical, cost, and schedule data at various sub-project levels. To date, 125 CADRes have been completed (90 covering historical projects plus 35 CADRes covering current projects) and an additional 55 are in process (33 for historical projects plus 20 for current projects).

NASA has made improvements based on informal feedback by those who have been using the CADRes. NASA will develop a formal survey once 50 CADRe are loaded into the automated system (ONCE) to make the CADRes available. This will allow NASA to obtain feedback on both the CADRe content and operation of the automated system.

1.8 INITIATIVE E3: Improved Cost/Schedule Performance Assessments and Reporting

Lead Executive:

Beth Robinson, Office of the Chief Financial Officer

Overall Status:

Initiative E3 has been completed and is operational. With the reorganization of the Strategic Investments Division (SID) from the IPCE office to the OCFO, the lead officer for this sub-initiative has been transferred as well.

Milestones:

Status	Milestone
Completed	Incorporate MPAR reports into NASA FY08 budget
Completed	Incorporate MPAR reports into NASA FY09 budget
Completed	Agreement with OMB on reporting on projects in development, or in formulation
_	with a development contract.
Completed	Draft LCC cost-tracking methodology
Completed	Develop draft formats for quarterly cost & schedule tracking.
Completed	Cost/Schedule tracking methodology & processes agreed to by NASA organization
_	and OMB.
Completed	Identify all requirements from OMB/Congress

Completed	Cost and schedule tracking and reporting process implemented
Completed	Reserve (UFE) policy established, included in 7120 series (see E1)
Completed	Cost/schedule reporting integrated into BPR
Completed	Produce first baseline & quarterly reports to OMB under final methodologies &
	processes.
Completed	Complete several quarters of reporting & reassess policy & process effectiveness.

Metrics:

The metrics for Initiative E3 have been met as follows:

- By December 31, 2008, 100 percent of projects subject to external cost/schedule reporting complied with the new NASA methodologies, processes, and formats designed to meet the reporting requirements of the OMB and Congress.
- By December 31, 2009, 100 percent of projects subject to external cost/schedule reporting provided quantifiable and substantiated data for integration into the BPR.
- The percent of life-cycle cost growth, development cost growth, schedule growth, and (for projects in formation) contract cost growth, as measured from the baseline value agreed to by the appropriate NASA decision authority at KDP-C, is reported to the BPR quarterly.
- Percentage of life-cycle and development cost and schedule growth of existing and future projects, as compared to cost and schedule growth on past projects. (This is to identify trends through time, on an annual basis.) January 2008 Update: This metric was baselined in December 2007 and is part of the 'High Risk' Success Metrics reported semi-annually.

Operational Status:

OCFO Strategic Investment Division (SID) obtains updated project cost, schedule, and contract value (for projects in formulation) estimates from each Mission Directorate on a quarterly basis. In situations where development-type contracts are awarded prior to entry of the project as a whole into development, contract value is updated as part of this quarterly data call. These updates are used to calculate any changes in project development cost or schedule, with the results reported to the BPR and to OMB. Changes in cost and schedule are calculated based on the project's established baseline, even if projects have re-planned for project management purposes. Re-baseline criteria are specified in 7102.5.

Any changes to the elements included in a project's budget and financial accounts (such as movement of indirect Center costs or direct project labor in or out of the project's accounts) would distort calculations of percentage cost growth. To avoid this problem, SID adjusts its calculations to ensure that the same project account elements are included in both the project baseline and the current costat-completion estimate. In response to NASA's proposed change to a single civil servant account, for example, SID is currently piloting a revised data collection template which will separately identify direct project labor and ensure that these costs continue to be reflected in reported estimates of cost growth. In addition, the OCFO is ensuring that budget and financial systems are able to cross-walk civil service labor costs back to individual projects. For those projects that entered development prior to these standardized cost and schedule updates being established, IPCE and SID have jointly estimated the cost and schedule baseline at project confirmation based on current project account structure.

This quarterly cost and schedule data provides project-specific and portfolio information for NASA's senior managers about how project costs, cost profiles, and Work Breakdown Structure (WBS) elements are changing as the project progresses. BPR assessors independently identify the

technology, cost, schedule, or programmatic issues that contribute to each change in estimated cost or schedule.

1.9 INITIATIVE F1: Business Concept of Operations (ConOps)

Lead Executive:

Linda Cureton, Chief Information Officer

Overall Status:

Initiative E3 has been completed and is operational.

Milestones:

Status	Milestone
Completed	Complete framework document, "NASA Concept of Operations - Business Process &
	Enabling Technology'
Completed	Complete 'starter pack,' "NASA Concept of Operations – Business Process &
_	Enabling Technology"
Completed	Hire permanent Integrated Enterprise Management Program (IEMP) Integration
	Manager responsible for developing ConOps
Completed	Complete Project Management Business System Gap Identification
Completed	Identify ConOps Stakeholders & charter ConOps Team
Completed	Confirm ConOps Scope
Completed	Develop Draft ConOps
Completed	Refine Draft ConOps
Completed	Perform Formal Document Review
Completed	Baseline ConOps

Metrics:

The Concept of Operations (ConOps) will be approved and integrated with the overall Enterprise Architecture and Agency IT Portfolio Management processes. This metric was completed in October 2008.

Operational Status:

The ConOps, adopted in October 2008, continues to serve as the baseline operational document for the Agency's IT systems. OCIO separately maintains information on IT applications.

The ConOps is intended to provide IT direction for five years. Working with the NASA Mission Support Offices, a Roadmap has been developed for the current and next two fiscal years which identifies either new IT projects or significant modifications to existing systems. Business process leads are then involved as a group with the OCIO in prioritizing proposed improvements.

1.10 INITIATIVE F2: Business System Gap Analysis

Lead Executive:

Linda Cureton, Chief Information Officer

Overall Status:

Initiative F2 has been completed and is operational.

Milestones:

Status	Milestone
Completed	Assign Acting Integration Manager and charter Management/Business Systems
	Integration Group
Completed	Complete plan for conducting data gap analysis
Completed	Receive authority to proceed
Completed	Identify representative projects
Completed	Identify & train gap analysis team
Completed	Complete gap identification
Completed	Prioritize gaps
Completed	Submit business system enhancement proposals to FY2011 budget process

Metrics:

Jan 2008 Update: The Agency will maintain an annual prioritized list of its top five business system gaps. Creating and maintaining such a list will constitute a successful outcome of this initiative. The Agency is maintaining this annual prioritized list and has implemented a process for resolving identified gaps

Operational Status:

Although IEMP has been completed, NASA is maintaining a prioritized list of its top five business system gaps based on criteria established by NASA's Operations Management Council (OMC) [now called the Mission Support Council]; a portfolio management structure remains in place within the OCIO; and the Management of Business Systems Integration Group (MBSIG) continues to function. NASA has operationalized a clear process for identifying potential gaps in its IT systems: assessing whether an IT improvement is required; evaluating the relative priority of potential IT improvements; and making decisions about IT investments to implement high priority improvements. NPR 7120.7 (NASA Information Technology and Institutional Infrastructure Program and Project Management Requirements) provides the policy framework for managing IT investments at each stage of formation and development.

As progress is made on addressing IT system gaps, emphasis is shifting from one of gapidentification to proposed system improvements. Potential gaps or improvements may be identified through day-to-day IT operations or through a periodic data call for candidate improvements. Smaller investments may be undertaken directly by process owners. Larger investments include development of a business case. Once in formulation, the business case will continue to evolve, informing the development decision.

The results of two data calls – one in 2008 and one in 2009 – provide some insights into how this process has developed. Of the dozen or so responses to the 2008 data call, roughly half were closed through process owner initiatives. The remaining open gaps were mapped into potential IT improvement projects and prioritized by Management/Business Systems Integration Group (MBSI).

The OMC approved the three MSBIG-recommended projects. Two of these IT improvements will have been completed by October 4, 2010 and one is being tracked under Initiative C, above.

Of 23 potential gaps identified in the 2009 data call (inclusive of gaps identified in 2008 and still deemed to be open), the MBSIG recommended two improvements (Emergency Notification and Contractor On-Boarding) proceed into Pre-Formulation activities. Two additional significant infrastructure gaps (Materials Management and Electronic Forms) were subsequently identified and the MBSIG re-prioritized the open proposals to incorporate these two new elements, rating them as being of higher priority than the 21 remaining proposals identified through the data call. Regular, interactive involvement with the functional business process leads has proven to be an efficient and accurate way to identify and mitigate IT gaps.

1.6 **INITIATIVE G: Procurement Processes and Policies**

Lead Executive:

William McNally, Assistant Administrator for Procurement

Overall Status:

Initiative G has been completed and is operational.

Milestones:

Status	Milestone
Completed	Complete policy improvements to acquisition strategy planning
Completed	Deploy Agency-wide standard contract writing application
Completed	Issue EVM procurement policy
Completed	Complete clarification of policy regarding acquisition of services
Completed	Complete award fee policy revisions
Completed	Review & clarify requirements for purchase request process improvements
Completed	Complete processing revision to purchase request form

Metrics:

"Total number of solicitations developed in PRISM as a percentage of those solicitations posted to NAIS." The 2009 target for this goal of 50 percent usage was significantly exceeded for 2009 with 73 percent usage.

Operational Status:

Contract Management Module (CMM)/PRISM software performance is reviewed monthly and system usage has exceeded goals through 2010 (projected).

• System usage as measured by number of user logons grew from a usage of 800 in mid-July to 869 logons during 2009 (the maximum number of users is 1000 per the PRISM license agreement with NASA).

- The number of solicitations developed in CMM/PRISM as a percentage of those posted to the NASA Internet Acquisition Service (NAIS) was 50 percent in FY 2008, rising to above 73 percent by end of FY 2009, on average above 90 percent in FY 2010.
- In March 2010, the Contract Management Module Performance Measurement Plan (CMM PMP) was modified to exchange Performance Measure 3.1.1 (system usage measure by the number of user logons) with a new performance measurement (percentage of purchase requisitions with an associated milestone plan). This metric gives a more accurate assessment of system usage than the number of user logons. In addition to monitoring system usage, Purchase Requisition Milestone Plans provide data for procurement reporting. In FY 2008, 8.3 percent of all new awards (excluding modifications) had an associated PRISM milestone template. By the first quarter of FY 2010, the percentage had increased to 75 percent, and for the second quarter to 91 percent.

With the recent implementation of the Enhanced Procurement Data Warehouse (EPDW) reporting tool in FY 2010, NASA should achieve 100 percent for the CMM PMP Measure 1.2.2, "Percentage of Effective Reports as a Percentage of CMM Required Reports."

2.0 PROJECT CORRECTIVE ACTION PLAN STATUS REPORTS

Sec 1203(b)(2) of the NASA Authorization Act of 2010 requires NASA to provide (a) a description of any project which has exceeded its development cost baseline by 15 percent or which has exceeded its development schedule by 2 years. Because NASA separately provides reports on any development projects with a schedule growth of 6 months under Sec. 103 of the NASA Authorization Act of 2005, the Agency is including projects with schedule growth between 6 months and 2 years in this report. This allows NASA to maintain continuity in cost and schedule performance reporting across these two sets of reporting requirements.

2.1 Projects Addressed

Of the 16 projects NASA currently has in development, five projects—Aquarius, Glory, JWST, NPP, and SOFIA—have either exceeded their development cost baseline by 15 percent or are more than six months behind their baseline development schedule. (See Table 1) Table 1 also illustrates the progression of NASA's cost estimation policies to include probabilistic cost confidence level (CL) analysis and then to joint cost and schedule confidence levels (JCL).

Of the five projects addressed here, four (Aquarius, Glory, NPP, and SOFIA) entered development prior to the Agency-wide Corrective Action Plan initiated in October 2007. The remaining project, JWST, is a transitional project which was baselined too early in the CAP implementation process to benefit from many of these improvements, including one key corrective action, the use of a joint probabilistic cost and schedule (JCL) analysis prior to establishment of a development baseline, adopted by the Agency in January 2009 as part of NASA Policy Directive (NPD) 1000.5A, Policy for NASA Acquisition.

Table 1: Projects in Development Baselined as of the 2011 Congressional Budget Justification

Project in Dev	KDP-C date	JCL Assessment prior to Baseline being set?	Rebase- line date	JCL Assessment prior to Re- Baseline?	Baseline Dev Cost (\$M)	Baseline Dev Schedule	=>15 percent increase in Dev Cost	=> 6 month delay in Dev Schedule
SOFIA	Dec 1996	No	Jul 2007	CL only*	920	Dec 2013	X	X
NPP	Jan 2003	analysis			593	Apr 2008	X	X
Aquarius	Jun 2005	CL only			193	Jul 2009	X	X
Glory	Nov 2005	CL only	Apr 2008	CL only	259	Jun 2009	X	X
MSL	Jun 2006	CL only	Jun 2009	JCL	1720	Nov 2011		
JWST	July 2008	CL only			2581	Jun 1014	X	X
Juno	Aug 2008	CL only			742	Aug 2011		
RBSP	Dec 2008	CL only			534	May 2012		
GRAIL	Jan 2009	CL only			427	Sep 2011		
MMS	Jun 2009	CL only			857	Mar 2015		
TDRS- K,L	Jul 2009	CL only			209	Dec 2013		
GPM	Dec 2009	CL only*			555	Jul 2013		
LDCM	Dec 2009	Yes			583	Jun 2013		
LADEE	Aug 2010	Yes			168	Nov 2013	-	-
MAVEN	Oct 2010	Yes			567	Nov 2013		
OCO II	Sept 2010	Yes			249	Feb 2013		

2.2 Common Corrective Action Elements

The narratives in Part 1 of this report on Initiative A2 (Improve Management Oversight of Project Cost, Schedule, and Technical Performance–State of the Agency Reporting) and Initiative E3 (Improved Cost/Schedule Performance Assessments and Reporting), provide a summary of common corrective action elements related to tracking and assessing the performance of these five projects (among others).

As part of the Agency's Baseline Performance Review (BPR), each of the five projects covered in this report are briefed monthly by a set of four (originally three) independent analysts from the Office of Chief Engineer (OCE), the Strategic Investments Division (within the OCFO), the Office of Safety and Mission Assurance (OSMA), and the Independent Program and Cost Evaluation (IPCE) office.

This independent assessment is initiated early in the formulation period and is consistently reported throughout the project lifecycle to track progress for each project. A set of pre-established criteria is used to determine a 'green,' 'yellow,' or 'red' rating for each project, and these ratings, along with an explanation, are reported to the Associated Administrator and NASA's senior management from across the Agency. Center directors separately report on how project elements at their centers are progressing. Mission Directorate leadership speaks to any 'yellow' or 'red' rated projects and explains the steps forward. In addition, for projects rated 'red,' the Project Manager presents his or her assessment, status, and steps forward to NASA's senior management.

Cost and schedule updates for each of these are provided to NASA's Strategic Investments Division (within the OCFO) on a quarterly basis; these updates are tracked and cumulative changes in cost and schedule are provided quarterly at the BPR. NASA is modifying this approach by adding an independent estimate of cost and schedule in this BPR reporting. As projects transition from formulation to development, there is consistency in the assessment of requirement maturity and alignment of the cost estimates.

3,0 PROJECT SPECIFIC CORRECTIVE ACTIONS

The following provide updates to corrective action information originally included in reports provided under Sec. 103 of the NASA Authorization Act of 2005. The JWST project does not yet have a Sec 103 threshold report and development of its corrective actions are in work. Immediate corrective actions for JWST are identified in Administrator Bolden's letter of November 9, 2010, transmitting the Independent Comprehensive Review Panel (ICRP) Final Report on JWST to Senator Mikulski. Additional corrective actions will be provided in the more detailed Agency response to the ICRP to be provided in early 2011.

3.1 AQUARIUS

Sec 103 Report date:

Project Description: NASA's Aquarius project is part of a joint undertaking with the Comisión Nacional de Actividades Espaciales (CONAE), the space agency of Argentina, and referred to as the Aquarius/SAC-D project. The implementation of Aquarius/Satellite de Aplicaciones Cientificas–D (Argentina) is governed by a Memorandum of Understanding (MOU), dated March 2, 2004. The Aquarius prime mission life is planned and funded for three years with a minimum requirement of one year of operations. The Aquarius project will implement an exploratory sensor capability designed to make pioneering space-based measurements of sea surface salinity (SSS) with the precision, resolution, and coverage needed to characterize salinity variations and investigate the linkage between ocean circulation, Earth's water cycle, and climate variability. Salinity data are required to determine seawater density, which in turn governs ocean circulation. SSS variations are governed by freshwater fluxes due to precipitation, evaporation, runoff, and the freezing and melting of ice.

The Aquarius SSS measurements will be used to address two key areas of NASA's Earth Science research strategy: 1) how global precipitation, evaporation, and the cycling of water are changing; and 2) how climate variations induce changes in the global ocean circulation. In meeting these objectives, Aquarius will also validate a space-based measurement approach and analysis concept that could be used for future systematic SSS monitoring missions.

The Aquarius/SAC-D project will be conducted using an observatory made up of the NASA-provided Aquarius instrument, SAC-D science instruments, and the SAC-D spacecraft bus (service platform) contributed by CONAE. CONAE's SAC-D requirements are technically and scientifically compatible with Aquarius; however, Aquarius is designated in the MOU as the prime mission instrument on SAC-D. The Aquarius/SAC-D mission operations will be conducted using an integrated mission operations system consisting of the CONAE observatory operations control center in Argentina, the Goddard Space Flight Center (GSFC) Aquarius science planning and data processing center, and the Jet Propulsion Laboratory (JPL) Physical Oceanography Distributed Active Archive Center (PODAAC) for data archive and distribution. NASA will be providing the Delta-II launch vehicle.

The NASA instrument, Aquarius, will retrieve SSS by microwave remote sensing of surface brightness temperature at L-band, which is governed by the surface salinity, temperature, and roughness (due to wind and waves). An integrated L-band microwave radiometer/scatterometer will be developed and deployed as the salinity measuring instrument, consisting of three beams in a pushbroom configuration. The radiometer (1.413 GHz) will measure the surface brightness temperature, which is related to the surface emissivity and physical temperature of the seawater. The surface emissivity is determined by the dielectric constant of seawater, which is related to salinity. The scatterometer (1.26 GHz) is required to provide coincident information of sea surface roughness, a critical correction term for retrieval of sea surface salinity. The Baseline Science Mission enables study of the relevant oceanic processes on intraseasonal to interannual time scales by resolving the SSS with 0.2 practical salinity units (psu) accuracy on monthly time scales for at least three years.

ISSUE	CORRECTIVE ACTION PLAN
ISSUE 1: Delays in the CONAE (Argentina Space Agency) SAC-D development (primarily	Programmatic – NASA instituted a weekly teleconference with senior CONAE management to review project status and ensure all parties are well informed.
associated with several minor technical issues and insufficient planning for integration and test activities) have led to	Technical - JPL has placed a senior systems engineer on site at the integration and tests facilities in Argentina and Brazil, respectively, with the purpose of monitoring CONAE progress and advising within the bounds of the JPL technical assistance agreement.
NASA cost overruns and schedule slips. NOTE: This issue is	Cost - The Aquarius project has worked to minimize the cost impact of schedule delays by reducing workforce to the lowest level required to support the remaining work. The resulting cost avoidance is estimated to be approximately \$1.5M.
entirely outside of NASA's responsibility in the partnership with Argentina.	Schedule - NASA has been working closely with CONAE to ensure the schedule is appropriate (based on NASA experience on missions of similar scope) for the remaining work, while ensuring mission success. In the past, the CONAE schedules have been optimistic, with not
CURRENT STATUS: NASA has taken steps to improve insight and	enough detail to make realistic assessments of the effort to complete the mission.
provide assistance to CONAE, within the limitations of ITAR.	

CORRECTIVE ACTION PLAN SUMMARY

ISSUE 2: Contamination	Technical - NASA/JPL provided support to CONAE on the removal,
of the SAC-D Observatory	shipment to the US vendor, and refurbishment of the DTMs. Without
Dual Thruster Modules	NASA support, it is estimated that the refurbishment effort would have
(DTMs) has led to CONAE	resulted in a significant delay of four months. The work NASA
schedule delays.	conducted minimized the schedule delay (by as much as 2 months) and
NOTE: This issue is the	reduced the potential for further damage to the Observatory and/or an
responsibility of CONAE.	on-orbit failure.
CURRENT STATUS: The refurbishment of all of the DTM flight units has been completed and the flight units were re- integrated with the observatory in October 2010.	noted in ISSUE 1, it is difficult to determine the exact impact of the DTMs contamination on the overall schedule. However, while the entire refurbishment process took approximately 2 months, the impact to the project schedule was more likely 4-6 weeks.

3.2 <u>GLORY</u>

Sec 103 Report date:

Project Description: Sunlight is the dominant direct energy input into the Earth's climate system, affecting all physical, chemical, and biological processes. Thus, it is critical to monitor solar output and measure aerosols that affect Earth's energy budget in complex ways that can have large effects on climate. The Glory mission will contribute to NASA's Earth science research effort by improving our understanding of atmospheric composition and solar irradiance as they relate to Earth's energy budget. These measurements will improve understanding of the natural and man-made factors that contribute to climate change. Specifically, the Glory mission will measure the geographical and temporal distribution of atmospheric aerosols, small airborne particles. In addition, Glory will make highly accurate and precise measurements of solar radiation. The Glory prime mission life requirement is for three years of operations, with a goal of five years. The instruments will operate continuously while on orbit.

Glory's science objectives are to: (1) determine the global distribution, microphysical properties, and chemical composition of natural and anthropogenic aerosols and clouds with accuracy and coverage sufficient for a reliable quantification of the aerosol direct and indirect effects on climate; and (2) measure the total solar irradiance to determine the Sun's direct and indirect effect on Earth's climate.

The Glory mission consists of two scientific instruments—the Aerosol Polarimetry Sensor (APS) and the solar Total Irradiance Monitor (TIM)—aboard a dedicated NASA spacecraft. The following is a description of each instrument:

The APS is an advanced polarimeter used for measurements that will increase our understanding of black carbon soot and other aerosols as causes of climate change. The APS will provide unprecedented measurements of the global distribution of natural and anthropogenic aerosols and clouds with accuracy and coverage sufficient for a reliable quantification of the aerosol direct and indirect effects on climate. The second instrument, the TIM, provides measurement continuity for the

more than 30-year solar irradiance data record by extending the measurement currently provided by NASA's Solar Radiation and Climate Experiment (SORCE).

The Glory satellite will fly in the low Earth orbit A-Train constellation (multiple spacecraft flying in close proximity to provide detailed observations of the Earth system) to assess the effectiveness of combining aerosol data with data from multiple instruments for enhanced scientific value.

The Glory project will respond to the Intergovernmental Panel on Climate Change (IPCC), and the prior Climate Change Science Program (CCSP), by continuing and improving upon NASA's research of the forcings influencing climate change in the atmosphere. The scientific knowledge provided by this project will be essential to predicting future climate change and making sound, scientifically-based economic and policy decisions related to environmental change.

ISSUE	CORRECTIVE ACTION PLAN
ISSUE 1: Late delivery of the Aerosol Polarimetry Sensor (APS) instrument due to technical issues and the move to a new facility at the development contractor. The APS was delivered two months later than planned in the April 2008 rebaseline.	Programmatic – In 2007, the APS development contractor, Raytheon Space and Airborne Systems (RSAS), closed the facility where the instrument was being designed and built, relocating all the development activities to a different RSAS facility. The APS development contractor experienced high turnover in the project's management and technical staff over this period, and was able to retain only a small fraction of the existing instrument development team as a consequence of the move. The project worked with RSAS to get them back on track by adding management and technical expertise to the instrument development and providing continuous rotational onsite NASA presence at the APS contractor plant.
As of March 2009, the APS was delivered and successfully integrated to the Glory Observatory.	Technical – Due to challenges in the instrument engineering activities, the project added management and technical expertise to the instrument development team at RSAS to facilitate rapid decision-making on technical issues related to the APS instrument and potential related impacts to the Glory observatory. This included providing continuous rotational onsite NASA presence at the APS contractor plant. Additional component-level risk mitigation testing was conducted at NASA's Goddard Space Flight Center.
	Schedule – As part of the cost mitigation strategy, NASA optimized the mission-level schedule and manpower to allow for the late delivery of the APS. NASA also facilitated the procurement/provisioning of schedule-critical parts.
ISSUE 2: The Glory Project was impacted by the unreliable low production yield of the Maxwell Single Board Computer (SBC).	Programmatic – Development and flight of the Maxwell SBC was originally planned to occur on the NPOESS mission and the Glory mission was to capitalize on the NPOESS SBC development efforts. After delays associated with the NPOESS mission, this removed all opportunities for Glory to benefit from any NPOESS SBC development. The Glory Project adopted completion of the development efforts associated for the Maxwell SBC. By June 2009, due to production

CORRECTIVE ACTION PLAN SUMMARY

CURRENT STATUS: In June 2009, the decision was made to rebaseline the Maxwell SBC with a BAE RAD750. This rebaseline decision drove the launch slip from June 2009 to November 2010 and the associated cost increases.	 issues that led to an unreliable yield, a decision was made to rebaseline the Maxwell SBC to the BAE RAD 750. Cost - The cost for the slip in launch readiness is reflected in the current estimate provided in this report. The Glory project reduced the cost impact (also technical and schedule risks) associated with continuing to improve the unreliable low production yield by rebaselining the SBC to a BAE RAD750, executing risk-mitigation activities, and incorporating the necessary regression testing in the observatory integration and test schedule. Schedule - Glory Integration and Test schedule was reworked to accommodate the late delivery of the BAE RAD 750 Payload Interface Processor (PIP). NASA worked closely with the Glory Project and Earth Systematic Missions Program Office to monitor the development and delivery status. Additionally, the June 2009 launch readiness date was moved 17 months to November 22, 2010.
ISSUE 3: The Glory mission was impacted by the required closure of the Taurus XL launch vehicle's Return to Flight activities following the loss of the Orbiting Carbon Observatory. CURRENT STATUS: In October 2010, NASA's Flight Planning Board approved the closure of the KSC/Launch Services Program's Return to Flight activities.	Programmatic –Following conclusion of the Mishap Investigation Board (MIB) that reviewed the loss of the Orbiting Carbon Observatory due to failure of the Taurus XL fairing system, NASA developed a corrective action plan with 19 corrective actions. On August 10, 2010, NASA convened a meeting to review and confirm closure of corrective actions up to that time and closed out 14 of the 19 corrective actions at that meeting. All remaining test activities required for the Taurus XL to return to flight were completed in September, and in October 2010, NASA's Flight Planning Board approved the Taurus XL for Return to Flight. At this point, however, the Return to Flight activities necessitated a delay from the November 22, 2010, launch readiness date. The new LRD of February 22, 2011, accommodated this delay as well as the delay caused by Issue 4.
ISSUE 4: The Glory mission was impacted by the repair of the -X Solar Array Drive Assembly (SADA). In August 2010, a previous anomaly led to an inspection of the -X SADA and revealed excessive wear to the Slip Ring Assembly (SRA). As a result, the -X SADA was deemed not worthy for flight.	 Programmatic – By late August 2010, the –X SADA was deemed not worthy for flight. The September 2010 –X SADA Recovery Plan included impacts to launch readiness. Cost - The Glory project reduced the cost impact associated with a full replacement of the –X SADA by procuring an Slip Ring Assembly (SRA) replacement for the –X SADA that was successfully designed, built, and tested for the Glory mission requirements. Schedule – The –X SADA SRA replacement was delivered 1 week earlier than planned. To mitigate schedule risk, the Glory Project conducted several technical reviews and pursued 3 parallel options. Upon the successful testing and delivery of a –X SRA replacement, the other 2 options were terminated. NASA's Science Mission Directorate

CURRENT STATUS:	worked closely with the Glory Project and Earth Systematic Missions
As of Nov. 14, 2010, the –	Program Office to monitor the -X SADA SRA development and
X SADA was repaired,	delivery status. The November 2010 launch readiness date was moved 3
tested, and delivered and	months to February 23, 2011.
successfully integrated to	
the Glory Observatory.	

3.3 NPOESS PREPARATORY PROJECT (NPP)

Sec 103 Report date:

Project Description: The NPOESS Preparatory Project (NPP) is a joint mission with the National Oceanic and Atmospheric Administration (NOAA) and the U.S. Air Force (USAF) to extend key environmental measurements. The satellite will provide ozone measurements, atmospheric and sea surface temperatures, humidity sounding, land and ocean biological productivity, cloud and aerosol properties, and Earth radiation budget measurements.

The NPP project will: provide a continuation of global change observations following the Earth Observing System missions Terra, Aqua, and Aura (specifically, atmospheric and sea surface temperatures, humidity sounding, land and ocean biological productivity, cloud and aerosol properties and Earth radiation budget measurements); and provide the Joint Polar Satellite System (JPSS) (previously the National Polar-orbiting Operational Environmental Satellite System [NPOESS]) with risk-reduction demonstration and validation for the critical JPSS/NPOESS sensors, algorithms, and processing.

The environmental data records (EDRs) scheduled to be produced by the interface data processing segment (IDPS) from the NPP data are: sea-surface temperature; vegetation index; ocean color; imagery; atmospheric temperature; moisture and pressure profiles; clear column radiances; aerosol optical thickness and particle size; surface albedo; land surface temperature; ice surface temperature; surface heat flux; cloud base height; cover and layers; cloud top temperature; height; cloud effective particle size and optical thickness; precipitable water; surface wetness; active fire detection; sea ice characterization; snow cover; suspended atmospheric matter; and surface type. Separate from the IDPS processing system, NPP data from the Clouds and the Earth's Radiant Energy System (CERES) instrument will be processed to produce solar-reflected and Earth-emitted radiation products.

The following describes the instruments that will provide these measurements:

- The Visible Infrared Imaging Radiometer Suite (VIIRS) instrument is a multi-spectral scanning radiometer with a 3000 km swath width and derives its heritage from Advanced Very High Resolution Radiometer (AVHRR), Operational Linescan System (OLS), Moderate Resolution Imaging Spectroradiometer (MODIS), and Sea-viewing Wide Field-of-view Sensor (SeaWIFS).
- The Cross-Track Infrared Sounder (CrIS) instrument is a Michelson interferometer. Its heritage is the High Resolution Infrared Radiation Sounder (HIRS), the Advanced Infrared Sounder (AIRS), and the Infrared Atmospheric Sounding Interferometer (IASI). It will produce daily global sets of high-resolution temperature and moisture profiles for scenes with less than 50 percent cloud cover. It is co-registered with the Advanced Technology Microwave Sounder (ATMS) and is designed to work in conjunction with it.
- The ATMS instrument is a passive microwave radiometer with a swath width of 2300 km. Its

heritage is the Advance Microwave Sounding Unit (AMSU) A1/A2 and the AMSU-B instrument. It provides the initial estimate of temperature and moisture profiles for input to an infrared algorithm, as well as an all-weather set of profiles.

- The Ozone Mapping and Profiler Suite (OMPS) will measure solar-scattered radiation to map • the vertical and horizontal distribution of ozone in Earth's atmosphere using a nadir ultraviolet (UV) sensor and limb-scanning UV/visible (VIS) sensors.
- The Clouds and the Earth's Radiant Energy System (CERES) will measure solar-reflected ٠ and Earth-emitted radiation products continuing the measurements started with the Earth Observing System satellites and the Earth Radiation Budget Experiment.

2010 ISSUES	CORRECTIVE ACTION PLAN
ISSUE 1: The NPP Project continued to be impacted by the late delivery of the Cross-track Infrared Sounder (CrIS) sensors provided by the NPOESS Integrated Program Office. The CrIS instrument delivery slipped from September 2009 to June 2010. This late delivery drove the launch date from January 2011 to October	Programmatic – In February 2010, the Administration directed the restructuring of the NPOESS Program into separate civil and defense operational satellite systems. NOAA and NASA were assigned primary responsibility for the afternoon orbit. NASA's role in the restructured program is modeled after the procurement structure of the POES and GOES programs, with NASA performing work on a reimbursable basis for NOAA. Although the restructure occurred too late to improve the delivery date for the remaining sensor for NPP it has allowed NASA to manage the JPSS ground segment, which will be used for NPP and was also delayed under the NPOESS management structure. The ground segment is now on track for the October 2011 launch of NPP.
2011 and resulted in an the associated cost increase of \$ 47M. NOTE: This issue is outside of NASA's responsibility in the partnership with NOAA and DoD. CURRENT STATUS: As of June 2010, the last sensor Cross-track Infrared Sounder (CrIS) was delivered for integration onto the NPP spacecraft.	Schedule-NASA has worked closely with the Integrated Program Office to monitor the instrument development and delivery status. The NPP project has worked to reduce the cost impact of the late delivery of the CrIS sensor by developing work-around activities and opportunities in the integration and test schedule. Specifically the Visible Infrared Imaging Radiometer Suite (VIIRS) instrument integration was pulled forward while the spacecraft team waited for the CrIS delivery, which allowed for some additional risk reduction testing to be performed. An expanded VIIRS end-to-end radiometric spectral response test was performed in March to verify the VIIRS performance, earlier than planned in the original test flow. This opportunity reduced risk to the overall test flow by avoiding additional delays due to issues identified earlier in the flow.

CORRECTIVE ACTION PLAN SUMMARY

3.4 SOFIA

Sec 103 Report date:

Project Description: The Stratospheric Observatory for Infrared Astronomy (SOFIA) is an airborne observatory that will study the universe in the infrared (IR) spectrum. These IR observations allow scientists to study the dust between stars, the formation of stars and new solar systems, the chemistry of the universe, and the deep universe where the most distance galaxies are seen in IR light. SOFIA will host a complement of scientists, computer engineers, graduate students, and educators on nightlong research missions. SOFIA will be a major factor in the development of observational techniques and of new instrumentation and in the education of young scientists and teachers in the discipline of IR astronomy. On December 1, 2010, SOFIA completed the first of three science flights representing Phase 1 of SOFIA's early science program to validate the observatory's capabilities. The flight employed the Faint Object InfraRed Camera for the SOFIA Telescope (FORCAST) instrument to observe the mid-infrared spectrum.

NASA and the Deutches Zentrum für Luft- und Raumfahrt (DLR), Germany's Aerospace Research Center and Space Agency, are working together to construct SOFIA, a Boeing 747SP aircraft which was modified by L-3 Communications Integrated Systems to accommodate a 2.5 meter reflecting telescope. SOFIA will be the largest airborne observatory in the world, and will make observations that are impossible for even the largest and highest of ground-based telescopes. SOFIA will operate at 41,000 feet using U.S. and German instruments and flights will last, on average, 6 to 8 hours. NASA recently redefined the Full Operational Capability (FOC) milestone to place greater emphasis on science and the overall program was subsequently re-planned around that definition. The new definition of FOC focuses on science instrument capability versus the number of flight hours per year and is consistent with the MPAR definition.

2010 ISSUES	CORRECTIVE ACTION PLAN
ISSUE 1: Late delivery of Cavity Door Drive System CURRENT STATUS: The cavity door drive system controller and actuator was delivered and integrated in the SOFIA observatory, and flight testing to clear the full flight envelope has been completed. This permitted the continuation of SOFIA system testing, leading to the successful first science flights in late November and early December 2010.	Schedule – Late delivery of software that operates the telescope observation doors on the aircraft resulted in later-than-planned initiation of open door flight testing and science observation by approximately 9 months. To accommodate this delay, NASA adjusted the test schedule to move forward those activities that did not require SOFIA to be airborne, including ground-based systems testing and line operations to observe the night sky from the ground. Programmatic - NASA stationed representatives at Woodward's facility to support and oversee the vendor until delivery of the cavity controller and actuator.

CORRECTIVE ACTION PLAN SUMMARY

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