The Joint Polar Satellite System: Program Must Use Realistic Schedules to Avoid Recurrence of Ground Project Delays and Additional Cost Increases

FINAL REPORT NO. OIG-18-024-A

AUGUST 2, 2018

U.S. Department of Commerce
Office of Inspector General
Office of Audit and Evaluation

UNITED STATES DEPARTMENT OF COMMERCE
Office of Inspector General
Washington, D.C. 20230

August 2, 2018

MEMORANDUM FOR: Rear Admiral Tim Gallaudet, Ph.D., USN Ret.
Assistant Secretary of Commerce for Oceans and Atmosphere
and Acting Under Secretary of Commerce for Oceans
and Atmosphere
National Oceanic and Atmospheric Administration

FROM: Frederick J. Meny, Jr.
Assistant Inspector General for Audit and Evaluation (Acting)

SUBJECT: *The Joint Polar Satellite System: Program Must Use Realistic Schedules to Avoid Recurrence of Ground Project Delays and Additional Cost Increases*
Final Report No. OIG-18-024-A

Attached is our final audit report on our audit of the National Oceanic and Atmospheric Administration (NOAA) Joint Polar Satellite System (JPSS) program. Our objective was to assess the cost, schedule, and technical performance of selected components of the JPSS program. Specifically, our objective was to assess factors of the JPSS ground project's efforts to complete the Block 2.0 upgrade of the ground system. We also set out to determine whether the project properly supported award fee decisions and effectively managed ground system contractor performance.

We found that

- the ground system upgrade presented technical challenges and took longer to complete than planned and
- the JPSS program can improve its management of the ground system cost-plus-award-fee contract.

On July 19, 2018, we received NOAA's response to the draft report's findings and recommendations, which we include within the report as appendix C. NOAA management concurred with all 10 report recommendations and noted actions it has and will take to address them.

Pursuant to Department Administrative Order 213-5, please submit to us an action plan that addresses the recommendations in this report within 60 calendar days. This final report will be posted on OIG's website pursuant to sections 4 and 8M of the Inspector General Act of 1978, as amended (5 U.S.C. App., §§ 4 & 8M).

We appreciate the cooperation and courtesies extended to us by your staff during our audit. If you have any questions or concerns about this report, please contact me at (202) 482-1931 or Kevin Ryan, Audit Manager, at (202) 695-0791.

Attachment

cc: Ben Friedman, Deputy Under Secretary for Operations, NOAA
Stephen Volz, Assistant Administrator for Satellite and Information Services, NOAA
Mack Cato, Director, Office of Audit and Information Management, NOAA

Report in Brief

August 2, 2018

Background

The Joint Polar Satellite System (JPSS) Common Ground System (hereafter, ground system) commands and controls National Oceanic and Atmospheric Administration (NOAA) polar satellites, ingests and processes data and imagery, and distributes products to users like NOAA's National Weather Service. The ground system also provides services for several domestic and international environmental satellite missions.

Ground system-related costs account for approximately 28 percent of the JPSS program's $11.3 billion total life-cycle cost estimate. The program has worked to complete a major upgrade of the ground system and launch the JPSS-1 satellite. Within the program, that effort was managed by a National Aeronautics and Space Administration ground project team (hereafter, the ground project). Raytheon Intelligence, Information, and Services is the prime contractor for the ground system and its sustainment.

Why We Did This Review

Our objective was to assess the cost, schedule, and technical performance of selected components of the JPSS program. Given its scale and complexity, we limited our scope for this audit to the ground system development effort and the program's management of the ground system contract.

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

The Joint Polar Satellite System: Program Must Use Realistic Schedules to Avoid Recurrence of Ground Project Delays and Additional Cost Increases

OIG-18-024-A

WHAT WE FOUND

We found that the ground system upgrade presented technical challenges and took longer to complete than planned. Specifically, we found that (a) the ground system upgrade was a large and complex effort, yet a key requirements review was abbreviated and a design review was omitted; (b) the schedule to complete the ground system upgrade was overly optimistic; (c) an optimistic schedule added risk to system development, integration, and test processes that were already challenged; (d) system integration, test, and verification efforts were further hindered by an unstable system as well as uncertain expectations between the government and the contractor; (e) capabilities were deferred to relieve pressure on the schedule; and (f) cost increases on the ground system contract risk exceeding the project's budget.

We also found that the JPSS program can improve its management of the ground system cost-plus-award-fee contract. Specifically, we found that (a) the contract performance evaluation plan (PEP) includes numerous performance evaluation criteria and inconsistencies in the process for award fee determinations, potentially reducing its effectiveness; (b) award period emphasis items did not effectively communicate what was important for contractor performance; (c) the government's scoring of contractor performance was not adequately documented or reviewed by senior management; and (d) the remaining available award fees are funds that could be put to better use through adherence to best practices and consistent implementation of management controls. Related to this finding, we identified $116,987,371 in questioned costs and $39,479,569 in funds to be put to better use.

WHAT WE RECOMMEND

In order to promote more efficient future development of the JPSS Common Ground System, we recommend that the NOAA Deputy Under Secretary for Operations do the following:

1. Institute program management council review of future development plans to ensure it is done in sufficiently small increments with achievable milestones.

Further, we recommend that the Assistant Administrator for Satellite and Information Services do the following:

2. Ensure that appropriate analyses are conducted to support decisions for omitting or tailoring project life-cycle reviews (e.g., requirements and design reviews).
3. Ensure that schedules are estimated using realistic, resource-loaded planning factors.
4. Ensure that the contractor conducts sufficient technical peer reviews to limit defects and rework.
5. Ensure that the government and contractor formally clarify roles, responsibilities, and expectations for future work to avoid issues that arose during the Block 2.0 integration and test phase.
6. Ensure that senior leadership maintains sufficient insight into cost risk on the ground system contract.

In order to improve the management of the JPSS Common Ground System cost-plus-award-fee contract and put remaining award fees to better use, we recommend the NOAA Deputy Under Secretary for Operations and the Assistant Administrator for Satellite and Information Services do the following:

7. Ensure that the ground system contract's PEP is revised to incorporate best practices for the use of performance factors and to clarify the award fee determination process.
8. Ensure that emphasis items (focus areas) provided to the contractor prior to each award period are clear, prioritized, and aligned with performance criteria.
9. Ensure that the award fee determination process is adequately documented in accordance with the PEP and best practices.
10. Ensure management controls are adequately integrated within the award fee determination process and that they are consistently implemented.

Contents

Cover: Herbert C. Hoover Building main entrance at 14th Street Northwest in Washington, DC. Completed in 1932, the building is named after the former Secretary of Commerce and 31st President of the United States.

Introduction

The Joint Polar Satellite System (JPSS) Common Ground System (hereafter, ground system) commands and controls National Oceanic and Atmospheric Administration (NOAA) polar satellites, ingests and processes data and imagery, and distributes products to users like NOAA's National Weather Service. The ground system also provides services for several domestic and international environmental satellite missions.

Ground system-related costs account for approximately 28 percent of the JPSS program's $11.3 billion total life-cycle cost estimate.[1] The program has worked to complete a major upgrade of the ground system and launch the JPSS-1 satellite. Within the program, that effort was managed by a National Aeronautics and Space Administration (NASA) ground project team (hereafter, the ground project).[2] Raytheon Intelligence, Information, and Services is the prime contractor for the ground system and its sustainment.[3]

[1] These include ground system development, operations and sustainment, "NOAA enterprise ground," and "other ground costs" according to JPSS program management reports.

[2] Program leadership intends to transition management of the ground project to NOAA in late FY 2018.

[3] For a full description of the JPSS program and its component projects, see U.S. Department of Commerce Office of Inspector General, April 26, 2016. *The Joint Polar Satellite System: Further Planning and Executive Decisions Are Needed to Establish a Long-term, Robust Program*, OIG-16-026-I. Washington, DC: DOC OIG, 24–27.

Objective, Findings, and Recommendations

Our objective was to assess the cost, schedule, and technical performance of selected components of the JPSS program. Given its scale and complexity, we limited our scope for this audit to the ground system development effort and the program's management of the ground system contract. We intend to assess the performance of other component projects in future work. For a more complete description of our objective, scope, and methodology, see appendix A.

We found that (1) the ground system upgrade presented technical challenges and took longer to complete than planned; and (2) the JPSS program can improve its management of the ground system cost-plus-award-fee contract.

I. The Ground System Upgrade Presented Technical Challenges and Took Longer to Complete Than Planned

The ground system upgrade—now identified as Block 2.0—was initiated in 2012. It consists of new hardware and software, capabilities for supporting JPSS-1, a full remote backup capability, additional antenna stations, multiple operating environments, and significant security enhancements.

The ground project initially planned to complete the upgrade in two increments: first, to support existing missions (Suomi National Polar-orbiting Partnership (Suomi NPP) and partner satellites[4]); and second, the JPSS-1 mission, with a schedule intended to allow operators to gain experience with the new version in advance of the JPSS-1 launch.[5]

However, the ground project encountered various obstacles, such as construction, development, and integration problems that delayed completion and added risk to the JPSS-1 launch schedule. The JPSS program attributed JPSS-1 launch delays primarily to problems experienced with the Advanced Technology Microwave Sounder and completion of the satellite. However, the ground system was not ready to support NOAA's original launch commitment date in the second quarter of fiscal year (FY) 2017. The ground system was approved for full operational use (i.e., including support for JPSS-1) in late October 2017, nearly 2 years later than planned, and more than a month before the (delayed) launch of JPSS-1.[6]

[4] These include satellites from the Department of Defense, European Organisation for the Exploitation of Meteorological Satellites, and the Japan Aerospace Exploration Agency.

[5] See DOC OIG, June 17, 2014. *Audit of the Joint Polar Satellite System: To Further Mitigate Risk of Data Gaps, NOAA Must Consider Additional Missions, Determine a Strategy, and Gain Stakeholder Support*, OIG-14-022-A. Washington, DC: DOC OIG, 13.

[6] JPSS-1 was launched on November 18, 2017, approximately 11 months later than the program's initial plan and 8 months beyond its commitment date. After launch, the satellite was renamed *NOAA-20*.

A. *The ground system upgrade was a large and complex effort, yet a key requirements review was abbreviated and a design review was omitted*

The initial JPSS ground system was not built with the redundancy and high-availability features of an operational weather satellite system. The Block 2.0 upgrade added these requirements along with a significant redesign of the system architecture. The program chose to revise the architecture based upon adaptable, open standards that allow NOAA to interface more easily with international and other partner systems for mission data.[7] The upgrade also provides functionality to support multiple missions, continuity of operations, and includes increased security features.

However, the new architecture and requirements also added complexity and technical challenges. For example, incompatibilities between security and database software products stalled progress for weeks as engineers diagnosed errors and implemented fixes. The contractor and government project team attributed the complexity challenges to multi-mission capabilities, new performance capabilities, and security requirements.

Despite the scale and complexity of the planned upgrade, the ground project conducted an abbreviated system requirements review and did not conduct a preliminary design review, which would normally occur under JPSS project management standards.[8] Instead, primarily due to schedule pressure, the ground project held a high-level review of requirements and then progressed directly to a critical design review (CDR) where detailed designs were evaluated for readiness to proceed with assembly, integration, and testing. However, the contractor's design was not as mature as expected at the CDR; that is, system requirements had not been fully specified and the program needed additional time to finalize them. As a result, work on lower-level detailed design occurred without a validated higher-level design. This led to defects that had to be remediated later in the development cycle. As such, we conclude that the abbreviated design review process further strained technical and management capabilities to complete a large and complex upgrade.

B. *The schedule to complete the ground system upgrade was overly optimistic*

A completed CDR should have indicated the technical effort was on track and within cost and schedule constraints. However, three months after the CDR, the ground project and a review board noted concerns with the maturity of the schedule. Most of the ground project personnel we interviewed described the schedule as having little margin for error due to its aggressive, success-driven, and compressed nature.

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[7] See DOC OIG, September 27, 2012. *Audit of the Joint Polar Satellite System: Continuing Progress in Establishing Capabilities, Schedules, and Costs Is Needed to Mitigate Data Gaps*, OIG-12-038-A. Washington, DC: DOC OIG, 6.

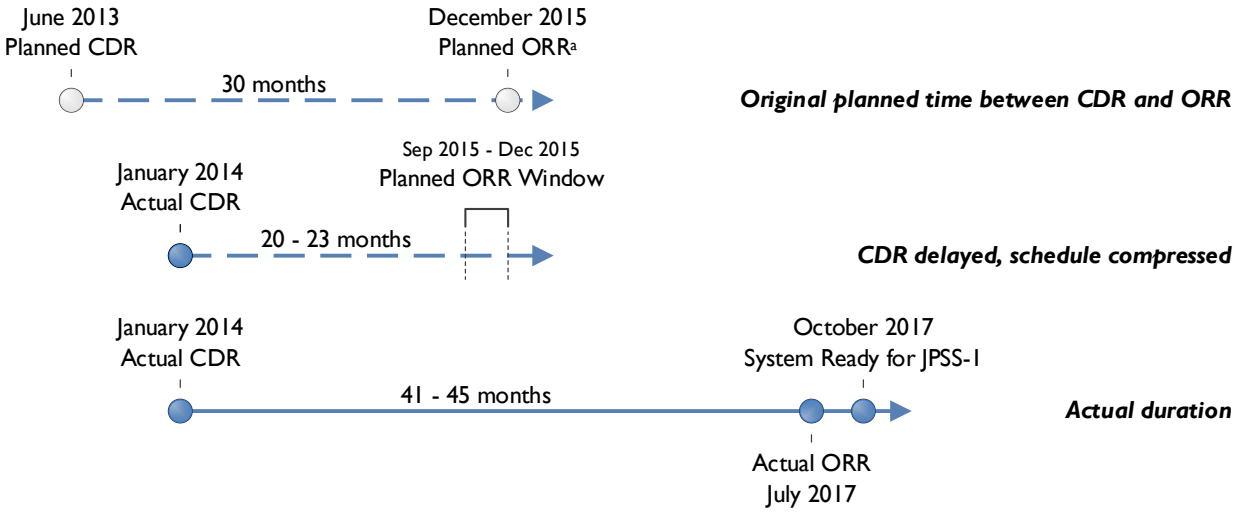
[8] A *system requirements review* is performed to examine the functional and performance requirements defined for the system to ensure that the requirements and concept satisfy the mission. A *preliminary design review* is performed to evaluate whether correct design options, interfaces, and verification methods have been identified. Both of these reviews are held before boards of subject matter experts. See National Aeronautics and Space Administration, August 14, 2012. *NASA Space Flight Program and Project Management Requirements*, NPR 7120.5E. Washington, DC: NASA.

Compression of the schedule led to increased parallel activities associated with the project, and consequently decreased the likelihood it would be sustainable.[9]

According to project personnel, the schedule was constructed primarily by fitting all the required tasks into an allotted time window rather than a bottom-up estimate approach.[10] In February 2017, project personnel performed an internal lessons-learned review and acknowledged that a bottom-up approach would have been more appropriate.

Furthermore, we found optimistic assumptions were evident in the ground project schedule from an examination of the project's high-level schedule milestones. The project's initial timeframe for completion of system integration and testing activities leading to operational readiness was 30 months. However, the start of the activity (the CDR) was delayed but the operational readiness milestone (that is, the Operational Readiness Review (ORR)) date was retained, leaving 23 months for the same tasks. Ultimately, the project took from 41 to 45 months to complete the activities and verify that the system was ready for JPSS-1 operations—approximately twice as long as the schedule presented at the CDR (see figure 1).

Figure 1. Ground System Upgrade Integration and Test Plans Versus Actual



CDR: Critical Design Review for Block 2.0
ORR: Operational Readiness Review for Block 2.0

Source: OIG, adapted from JPSS program schedules in 2012, 2014, and 2017, respectively.

[a] In 2012, the program identified this as the transition to operations milestone, which we deemed equivalent to ORR for this comparison.

[9] Parallel task assignment is a technique used to perform multiple activities simultaneously within a defined time window. An excessive number of parallel tasks can indicate an overly aggressive or unrealistic schedule. See U.S. Government Accountability Office, December 22, 2015. *GAO Schedule Assessment Guide: Best Practices for Project Schedules*, GAO-16-89G. Washington, DC: GAO, 46.

[10] Ibid., 69. Best practice calls for activity durations estimated under conditions that are most likely rather than optimal or success-oriented. This implies that duration estimates not be unrealistically short or arbitrarily reduced by management to meet a program challenge.

C. An optimistic schedule added risk to system development, integration, and test processes that were already challenged

To meet its operational readiness milestone, the contractor had to plan tasks with shorter time durations and lower margins for contingency work, such as defect troubleshooting. This added more risk to the software development and system configuration management efforts, which were already challenged by the scale and complexity of the upgrade. As a result, these processes were negatively impacted, causing delays, additional work, and the need to defer the completion of some requirements.

Software build quality suffered under schedule pressure. Project management and contractor performance monitor reports indicated that the quality of software builds was sub-optimal. Some coding errors were described as basic defects that should have been discovered during initial testing, while others were attributed to making fixes without testing backward-compatibility in order to meet the project's aggressive schedule. Early individual component tests did not reveal a majority of defects. Instead, many software defects manifested in operational tests of the integrated system. This made them more complicated to troubleshoot.

Recognizing there was an issue, the JPSS ground project and the contractor jointly determined that the contractor's software review process was not adequately identifying defects. Notably, the ground project determined that the software review periods were short: lasting 2 days compared with the 5-day industry standard. The ground project recommended lengthening the review periods but the contractor resisted, citing schedule performance demands that it needed to meet according to the government's evaluation criteria for earning performance-based award fee payments.

Configuration management presented challenges. Configuration management is a discipline applied over a product's life cycle to provide visibility into and to control changes to performance, functional, and physical characteristics. The contractor struggled to manage the configuration of the Block 2.0 ground system during the integration and test effort, which contributed to delays in tests needed for government acceptance of the software. For example, problems arose with inconsistent router configurations, incorrect passwords, hardware conflicts, database inconsistencies, and undocumented changes not captured during system deployment. These lapses in configuration control caused rework and delays.

As a result, the contractor held technical summits[11] in 2015 and 2016 to address the configuration management issues. One finding resulting from the summits was that the contractor needed to automate tasks such as software configuration maintenance and installations. Although the contractor procured tools to help reduce systemic configuration problems, the contractor concluded that the scale and complexity of the

[11] These technical summits were Raytheon-organized reviews intended to look across its organizational structure to determine lessons learned and best practices to apply to the project.

ground system, and the volume of software problems, were outpacing its corporate processes to manage and control system configurations.

D. System integration, test, and verification efforts were further hindered by an unstable system as well as uncertain expectations between the government and the contractor

The contractor's system integration and test plan approved at the CDR in January 2014 included a phased test approach. As software deficiencies accumulated, the phased testing did not progress as planned. Nine months after the CDR, the government and the contractor jointly agreed to change to a NASA operations-based model for completing system integration and testing, which was intended to get the upgrade effort back on schedule. The revised approach involved an operations-based test on the fielded system before testing lower-level requirements in a factory setting. As we noted in a previous report,[12] the approach carried risk that it would be more challenging to troubleshoot problems and delay discovery of latent defects.

Although there was no formal change in contract scope or cost, the change to the operations-based test approach required the reallocation of contractor personnel and equipment resources. The details of the new approach were devised in technical meetings between the contractor and the government. The contractor delivered a brief memorandum to the government that outlined the basic concept. The government relied on the contractor to update and revise test procedure documentation to incorporate the new approach as appropriate.

However, the operations-based test approach was not successful and test objectives had to be moved to later test events. Throughout the operations-based test execution, the ground system was unstable due to a high number of defects (as described in finding I.C.), which delayed overall integration efforts. The contractor could not fix system defects prior to test events, requiring additional software builds. Ultimately, the ground project took control of the remaining testing from the contractor.

Both government and contractor personnel told us that differences in expectations affecting specific roles and responsibilities resulted in confusion and delays in requirements verification. We learned that the ground project's expectations for verifying system requirements were not well understood by the contractor, both during the operations-based testing and after. Further, contractor personnel told us that NASA's expectations were not clear as late as June 2017. This was consistent with other evidence showing the contractor was not satisfying the ground project's verification expectations. Following the September 2017 JPSS-1 ORR, the verification of ground system requirements was still incomplete, just 2 months prior to launch.

[12] See OIG-16-026-I, 13.

E. Capabilities were deferred to relieve pressure on the schedule

Because the ground system development was delayed, the program decided to defer the completion of certain ground system capabilities[13] that could be delivered after launch. In some cases, deferred capabilities necessitated a manual workaround if the functionality is required for current operations.

As of September 2017—2 months before the JPSS-1 launch—there were approximately 65 workarounds in place to satisfy the most critical of deferred capabilities. Though the operational leadership at the National Environmental Satellite Data and Information Service (NESDIS) has to approve and ensure proficiency of such measures, the workarounds could increase the likelihood of introducing errors. Even though an individual workaround may be manageable, too many concurrent workarounds could negatively affect operator workload and mission execution.

F. Cost increases on the ground system contract risk exceeding the project's budget

Problems and delays with ground system development have led to an increase in cost risk for the ground system contract. Ground system changes required to support a new JPSS-2 spacecraft design[14]—including its interfaces with the satellite—are a noted risk that could exceed the contract's current allocated budget. Given the remaining development and sustainment work planned for the ground system (see table 1), the program will need to ensure that challenges are managed appropriately to avoid increases that could lead to additional cost growth or overrun.

Table 1. Planned JPSS Ground System Development Blocks

Block	Mission	Changes	Transition to Operation
2.0	Suomi NPP / JPSS-1	Operation and Sustainment	2018
2.1	Suomi NPP / JPSS-1	Functional Requirement Deferrals – Incremental Update to Block 2.0 to Add Functionality	JPSS-1 Launch +9 Months
2.2	JPSS-2	Incremental Changes to Block 2.0/2.1 Capabilities	2020 (Q1)
3.0	JPSS-2 (launch)	Technical Refresh and Deferrals	2020 (Q3)

Source: JPSS Common Ground System Block 2.2 Preliminary Design Review, August 2017

The initial ground system contract with Raytheon Intelligence, Information, and Services was awarded in 2010 and valued at $1.4 billion. Subsequent modifications to the contract have increased the value to $1.8 billion. Almost half of the cost increase

[13] Deferrals associated with Block 2.1 consist of (a) situational awareness capabilities, (b) improved mission management capabilities, (c) a web-based collaboration tool, and (d) a common repository for databases.

[14] New spacecraft design is due to change in supplier: Ball Aerospace for Suomi NPP and JPSS-1; Orbital ATK for JPSS-2 with options for JPSS-3 and JPSS-4.

($185 million) is related to changes in requirements for the upgraded ground system architecture (Block 2.0). The remaining increase reflects modifications for government-directed changes in scope.

However, in June 2015 the project began spending more to complete the work than it had budgeted. Starting in August 2015 the ground contractor's earned value management system projected a cost overrun at completion. As of December 2017 the projected cost overrun was $18.6 million. To date, the ground project has not adjusted the contract value because the cost overrun is within its management reserves.

Recommendations

In order to promote more efficient future development of the JPSS Common Ground System, we recommend that the NOAA Deputy Under Secretary for Operations do the following:

1. Institute program management council review of future development plans to ensure it is done in sufficiently small increments with achievable milestones.

Further, we recommend that the Assistant Administrator for Satellite and Information Services do the following:

2. Ensure that appropriate analyses are conducted to support decisions for omitting or tailoring project life-cycle reviews (e.g., requirements and design reviews).
3. Ensure that schedules are estimated using realistic, resource-loaded planning factors.
4. Ensure that the contractor conducts sufficient technical peer reviews to limit defects and rework.
5. Ensure that the government and contractor formally clarify roles, responsibilities, and expectations for future work to avoid issues that arose during the Block 2.0 integration and test phase.
6. Ensure that senior leadership maintains sufficient insight into cost risk on the ground system contract.

II. The JPSS Program Can Improve Its Management of the Ground System Cost-Plus-Award-Fee Contract

The JPSS program has developed and sustained its ground system through a cost-plus-award-fee contract with Raytheon Intelligence, Information, and Services. One of our sub-objectives was to assess the effectiveness of the program's management of ground system contract performance.

We found that (a) the contract's performance evaluation plan (PEP) includes numerous performance evaluation criteria, potentially reducing its effectiveness, (b) award period emphasis items did not effectively communicate what was important for contractor performance, and (c) government scoring of contractor performance was not adequately documented or reviewed by senior management, resulting in approximately $117 million in unsupported costs. In addition, we identified approximately $39.5 million of remaining award fees that could be put to better use if the ground project adheres to best practices for cost-plus-award-fee contracts and ensures implementation of management controls over award fee determinations.

A. The contract PEP includes numerous performance evaluation criteria and inconsistencies in the process for award fee determinations, potentially reducing its effectiveness

OMB guidance for cost-plus-award-fee contracts stresses that performance evaluation factors be

- meaningful and measurable;
- directly linked to cost, schedule, and performance results; and
- designed to motivate excellence in contractor performance by making clear distinctions in possible award earnings between satisfactory and excellent performance.[15]

NASA guidance indicates a PEP should be kept as simple as feasible, with a limited number of performance factors and subfactors that are weighted for relative importance.[16] This guidance intends to increase the effectiveness of the plan by focusing on what is most important to the government.

We found that the JPSS ground system contract's PEP identifies more than twice as many performance evaluation subfactors compared with benchmarks (see table 2). While NASA guidance does not indicate an upper limit on the number that may be used, it does indicate that too many evaluation factors could dilute emphasis of what is

[15] Memorandum, "Appropriate Use of Incentive Contracts," December 4, 2007, Office of Management and Budget.

[16] NASA, August 2001. *Award Fee Contracting Guide*. Washington, DC: NASA: section 3.4.1, "Performance Evaluation Factors." In evaluating the management of the ground system cost-plus-award-fee contract, we considered its first nine award fee periods, which covered from July 2011 to July 2017. The NASA *Award Fee Contracting Guide* was updated in September 2017, but the August 2001 *Award Fee Contracting Guide* was the authoritative guidance in place during the scope of this audit.

most important. Further, the subfactors are not weighted (for scoring purposes) or prioritized by relative importance, as recommended by NASA guidance.[17]

Table 2. Comparison of Performance Evaluation Criteria

Source	Performance Criteria	
	Major Factor Areas	Subfactors
NASA Award Fee Guide	Technical, Cost, Management	7
GOES-R Spacecraft Contract	Technical, Cost, Management	11
JPSS Ground System Contract	Technical, Cost, Management, Schedule	25

Source: OIG analysis of NASA's *Award Fee Contracting Guide*, GOES-R spacecraft contract PEP, and JPSS ground system contract's PEP

We also found inconsistencies in the PEP regarding the sequence and timing of the award fee determination process. For instance, in one section the PEP directs performance monitors to submit their reports to the performance evaluation board, though elsewhere it says to deliver them to the contracting officer's representative by the same date, with only oral presentations to the board if needed. In another example, the PEP says the board meets to discuss performance monitor reports and prepare preliminary findings by 30 days after the end of the period, yet in another section it indicates the board meets promptly after the end of the period and prepares summary findings and recommendations. In addition, the PEP does not include a requirement to obtain the written input of the NESDIS Assistant Administrator, and the actual fee determination process provides only 5 days for doing so. This may have contributed to the management control deficiency described in finding II.C.

B. Award period emphasis items did not effectively communicate what was important for contractor performance

The PEP indicates that before each evaluation period, "the government will provide [the contractor with] a list of emphasis or other high-priority items (significant award fee criteria for each performance factor) that are targeted for contractor attention." We found that the ground project's award period emphasis items—called "focus areas"—were too numerous, not prioritized, and not sufficiently aligned with performance evaluation factors. We concluded that the emphasis items have not been effective at communicating what is most important for ground system contractor performance.

For the first nine award periods of the contract, between July 2011 and July 2017, there was an average of 64 focus area task items during each period, varying from as few as 36 to as many as 123. At least a third were based on evaluating contractor intermediate

[17] NASA, *Award Fee Contracting Guide*, section 3.4.3, "Weighting of Evaluation Factors" (August 2001).

processes,[18] and over half were repeat items from one period to the next. Contractor personnel told us the government's focus areas were not helpful for understanding the government's priorities. After receiving a lower performance evaluation than expected, the contractor's project manager requested regular meetings with the JPSS ground project to clarify expectations and priorities.

The focus areas also did not emphasize the government's most significant performance concerns communicated in award fee determination letters. For example, configuration management was a repeated performance concern in the award letters for nearly 6 years, starting with period 2 in 2012. Yet, configuration management was not an item of emphasis among the focus areas until period 8 in 2016, when it was broken out as one of nine main headings among approximately 50 individual items.

C. The government's scoring of contractor performance was not adequately documented or reviewed by senior management

The ground system contract's PEP states that in determining award fees, "the Government attempts to utilize objective and quantifiable measures to the greatest extent possible." Further, NASA guidance for award fee contracts indicates that appropriate documentation is vital and that documentation in support of award fee recommendations and computations is required.[19]

However, the program's documentation supporting award fee payments consisted of the following:

- individual performance monitor narrative reports with adjectival ratings (i.e., *Excellent*, *Very Good*, *Good*, *Satisfactory*, or *Unsatisfactory*);
- contractor self-evaluations; and
- final award fee determination letters with numerical scores for major performance factors and overall performance.

The program did not document how it used the individual performance monitor reports, recommendations of its performance evaluation board, and other information to determine award fee amounts. Overall, the program could not provide documentation supporting its adjudication, quantification, and weighting of performance monitor reports, and its calculation of earned award fees; with the process linkage for missing documentation as depicted in figure 2. Further, there is no documented methodology for converting performance monitors' adjectival ratings into scores or

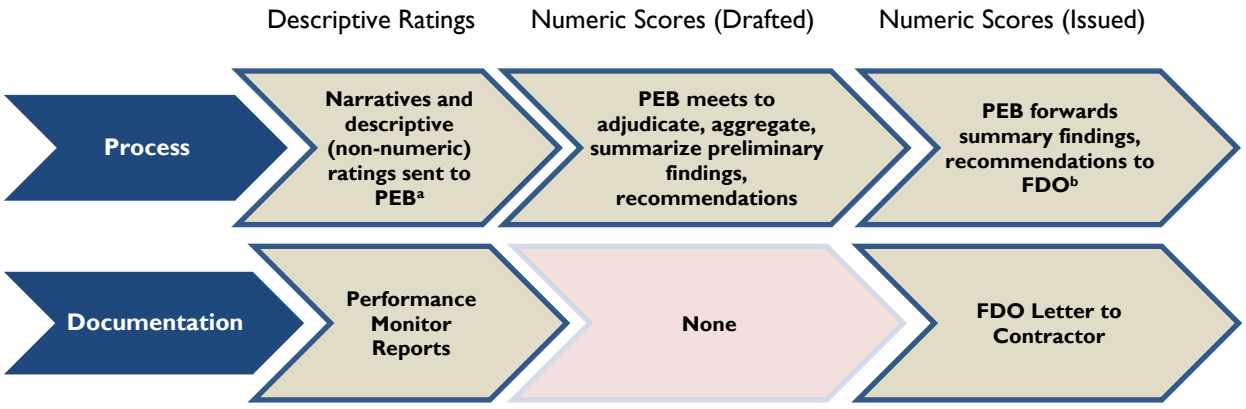
[18] In the context of this report, the NASA *2001 Award Fee Contracting Guide*, section 3.4, refers to such intermediate processes as *input-based* performance evaluation factors. It states that while it is sometimes valuable to consider such factors when evaluating contractor performance, it is NASA's preference to use outcome factors when feasible since they are better indicators of success relative to the desired result. An *outcome-based* performance evaluation factor is an assessment of the results of an activity compared to its intended purpose and is the least administratively burdensome.

[19] NASA, *Award Fee Contracting Guide*, section 3.7.4, "Documentation." (August 2001)

how performance monitor ratings are otherwise incorporated into performance evaluation board findings and recommendations.

We also found that while performance monitor reports discussed and rated major performance factors, they did not specifically identify, discuss, or rate performance subfactors. Overall, the lack of documented support for the performance scores weakens the credibility of the assessments and increases the likelihood that award fee determinations may be subject to bias or intuition.

Figure 2. Award Fee Determination Process and Documentation



Source: OIG analysis of the ground system contract's PEP and award fee documentation

[a] performance evaluation board

[b] fee determination official

Further, although a required management control,[20] in four out of six award periods there was no documented involvement of the Assistant Administrator for Satellite and Information Services in the award fee determination process. In one period, the award fee determination letter was signed and sent to the ground system contractor without involvement by any of NOAA's management. Consistent participation by the Assistant Administrator may have helped to inform or refine award fee decisions.

As a result of the lack of documentation and involvement of NOAA senior management in award fee decisions, we identified approximately $117 million in unsupported costs for award fees paid from June 2012 to July 2017. (See appendix B.)

D. The remaining available award fees are funds that could be put to better use through adherence to best practices and consistent implementation of management controls

The approximately $39.5 million of award fees that remain available on the ground system contract are funds that could be put to better use through improvements to the PEP and award period emphasis items, adequate documentation, and more consistent

[20] NOAA JPSS Office. January 2013 and October 2016. *NOAA/NASA Joint Polar Satellite System Management Control Plan*, JPSS-PLN-3107. Washington, DC: NOAA JPSS, section 2.1.1.1.

implementation of management controls over award fee determinations. (See appendix B.)

Recommendations

In order to improve the management of the JPSS Common Ground System cost-plus-award-fee contract and put remaining award fees to better use, we recommend the NOAA Deputy Under Secretary for Operations and the Assistant Administrator for Satellite and Information Services do the following:

7. Ensure that the ground system contract's PEP is revised to incorporate best practices for the use of performance factors and to clarify the award fee determination process.
8. Ensure that emphasis items (focus areas) provided to the contractor prior to each award period are clear, prioritized, and aligned with performance criteria.
9. Ensure that the award fee determination process is adequately documented in accordance with the PEP and best practices.
10. Ensure management controls are adequately integrated within the award fee determination process and that they are consistently implemented.

Summary of Agency Response and OIG Comments

In response to our draft report, NOAA agreed with all of our recommendations, and described actions it has taken and will take to address them. NOAA also recommended a factual change regarding the number of subfactors in the JPSS ground system contract's PEP, which we made in the final report. NOAA's complete response to our draft report is in appendix C.

We are pleased that NOAA concurs with our recommendations and look forward to reviewing the proposed audit action plan.

Appendix A: Objective, Scope, and Methodology

Our objective was to assess the cost, schedule, and technical performance of selected components of the JPSS program. Specifically, our objective was to assess the JPSS ground project's efforts to complete the Block 2.0 upgrade of the ground system. We also set out to determine whether the project properly supported award fee decisions and effectively managed ground system contractor performance.

Our scope included the procurement of JPSS ground system delivered under NASA contract NNG10XA03C with Raytheon Intelligence, Information, and Services. In evaluating the management of the ground system cost-plus-award-fee contract, we considered its first nine award fee periods, which covered July 14, 2011, to July 31, 2017.

To assess ground project performance, we assessed key risks to the JPSS-1 schedule by reviewing project management reports and schedules and comparing them with established baselines and milestones. We reviewed monthly and weekly program status reports to identify ground system development, integration and test issues and risks, as well as cost and schedule impacts. We reviewed the ground system contract change orders and modifications for potential cost growth and deferral of technical requirements. We compared the results of earned value management system metrics calculated by the contractor with project management actions. In addition, we examined the ground project's activities to manage the integrated schedule, project plan, software development plan, configuration management plan, quality audits, and technical performance.

To evaluate the program's performance management of the ground system contract, we compared the contract's PEP and evidence of the government's monitoring and assessment of contract performance with criteria in the NASA *Award Fee Contracting Guide*,[21] NASA FAR supplement, Procurement Information Circular 10-17, and the *JPSS Management Control Plan*. We compared individual performance monitor report narratives and ratings with actual award fee determinations. We also compared the work emphases communicated to the contractor with the government's stated priorities.

Our findings were informed by interviews of NOAA, NASA, and Raytheon management and staff. We also observed NOAA/NASA joint agency program management council proceedings, and several program management and project life-cycle milestone reviews.

We also assessed internal control significant within the context of our objectives. This included examining the design of program management controls as documented in program plans. We evaluated the implementation of internal control through document reviews and assessments of

[21] NASA, August 2001. *Award Fee Contracting Guide*. Washington, DC: NASA. As mentioned above, in evaluating the management of the ground system cost-plus-award-fee contract, we considered its first nine award fee periods, which covered from July 2011 to July 2017. The NASA *Award Fee Contracting Guide* was updated in September 2017, but the August 2001 *Award Fee Contracting Guide* was the authoritative guidance in place during the scope of this audit.

coordination among the program, NASA, and NOAA to determine the program's adherence to its standards, procedures, and plans. In satisfying our objectives, we did not rely on un-validated computer-processed data; therefore, we did not test the reliability of NOAA and NASA information technology systems. The findings and recommendations in this report include our assessments of internal control.

Although we could not independently verify the reliability of all the information we collected, we corroborated evidence with other available supporting documents to determine data consistency and reasonableness. Based on these efforts, we believe the information we obtained is sufficiently reliable for this report.

We performed our fieldwork from January 2017 to December 2017 at the JPSS program office in Lanham, Maryland; at NESDIS offices in Silver Spring, Maryland; and at Raytheon facilities in Aurora, Colorado. We conducted this review under the authority of the Inspector General Act of 1978, as amended, and Department Organization Order 10-13, dated April 26, 2013.

We conducted this performance audit in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence that provides a reasonable basis for our findings and conclusions based on our audit objective. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objective.

Appendix B: Potential Monetary Benefits

Description	Questioned Costs	Funds to Be Put to Better Use
Unsupported Award-Fee Payments	$116,987,371[a]	
Balance of Award-Fee Pool		$39,479,569[b]

[a] This amount includes award fees paid from June 1, 2012, to July 31, 2017.

[b] The balance of the award fee pool consists of funds for the remaining award periods that span from August 1, 2017, to September 30, 2022.

Appendix C: Agency Response

UNITED STATES DEPARTMENT OF COMMERCE
The Deputy Under Secretary for Operations
Washington, D.C. 20230

JUL 19 2018

MEMORANDUM FOR: Frederick J. Meny, Jr.
Acting Assistant Inspector General for Audit and Evaluation

FROM: Ben Friedman
Deputy Under Secretary for Operations

SUBJECT: *The Joint Polar Satellite System: Program Must Use Realistic Schedules to Avoid Recurrence of Ground Project Delays and Additional Cost Increases*
Draft OIG Audit Report

The National Oceanic and Atmospheric Administration (NOAA) is pleased to submit the attached response to the Office of Inspector General's draft report on NOAA's Joint Polar Satellite System Ground Project. We agree with the 10 recommendations and have included one comment in the attached response.

We appreciate the opportunity to review and respond to your draft report. If you have questions, please contact Mack A. Cato, Director, Audit and Information Management Office on (301) 628-0949.

Attachment

Department of Commerce
National Oceanic and Atmospheric Administration
Comments to the OIG Draft Report Entitled
"The Joint Polar Satellite System (JPSS): Program Must Use Realistic Schedules to Avoid Recurrence of Ground Project Delays and Additional Cost Increases"
(June 2018)

General Comments:

The Department of Commerce's National Oceanic and Atmospheric Administration (NOAA) appreciates the opportunity to review and comment on the Office of the Inspector General's (OIG) draft report on the JPSS Ground Project. NOAA has reviewed the report and agrees with OIG's 10 recommendations. The response to each recommendation is provided below. Additionally, NOAA recommends one factual and technical change to the report, which is provided to ensure that the information presented is complete, accurate, and up-to-date.

Recommended Change for Factual/Technical Information:

The audit states (at Table 2) that the JPSS Ground System Contract contains 27 subfactors within the major factor areas of technical, cost, management and schedule. There are 25 subfactors, rather than 27 subfactors. The bullets in performance evaluation plan (PEP) provide guidelines and they are not considered to be subfactors. We recommend changing "27 subfactors" to "25 subfactors".

OIG Recommendation 1:
In order to promote more efficient future development of the JPSS Common Ground System, we recommend that the NOAA Deputy Under Secretary for Operation do the following: Institute program management council review of future development plans to ensure it is done in sufficiently small increments with achievable milestones.

NOAA Response to Recommendation 1: Concur. The review of future development plans and milestones will be presented as part of the program's inputs to the Agency Program Management Council (APMC).

OIG Recommendations 2-6: Further, we recommend that the Assistant Administrator for Satellite and Information Services do the following:

Recommendation 2: Ensure that appropriate analyses are conducted to support decisions for omitting or tailoring project life-cycle reviews (e.g., requirements and design reviews).

NOAA Response to Recommendation 2: Concur. As part of its APMC oversight role, NESDIS will monitor the program's activities to ensure appropriate analyses are conducted to support decisions for omitting or tailoring project life-cycle reviews.

Recommendation 3: Ensure that schedules are estimated using realistic, resource-loaded planning factors.

NOAA Response to Recommendation 3: Concur. Similarly, as part of its APMC oversight role, NESDIS will monitor the program's schedules to ensure they are estimated using realistic, resource-loaded planning factors.

Recommendation 4: Ensure that contractor conducts sufficient technical peer reviews to limit defects and rework.

NOAA Response to Recommendation 4: Concur. NESDIS will ensure that the program conducts sufficient and appropriate technical peer reviews to limit defects and rework.

Recommendation 5: Ensure that the government and contractor formally clarify roles, responsibilities, and expectations for future work to avoid issues that arose during the Block 2.0 integration and test phase.

NOAA Response to Recommendation 5: Concur. Upon receipt of the JPSS Ground contract, NOAA will identify the COR, Alternate COR(s), and Task Manager(s) in compliance with CAM 1301.670. The Contracting Officer and Program Manager will ensure expectations and requirements are communicated to the contractor to prevent ambiguity in the future.

Recommendation 6: Ensure that senior leadership maintains sufficient insight into cost risk on the ground system contract.

NOAA Response to Recommendation 6: Concur. A dedicated contract cost/price analyst will mitigate contract risks on contracts of this magnitude, and enable further communications with leadership on existing and emerging cost risks. JPSS provides monthly budget execution briefings to senior leadership as well as provides senior leadership an overall annual planning, programming, and budget overview.

OIG Recommendations 7-10

In order to improve the management of the JPSS Common Ground System cost-plus-award-fee contract and put remaining award fees to better use, we recommend that the NOAA Deputy Under Secretary for Operation and the Assistant Administrator for Satellite and Information Services do the following:

Recommendation 7: Ensure that the ground system contract's PEP is revised to incorporate best practices for the use of performance factors and to clarify the award fee determination process.

NOAA Response to Recommendation 7: Concur. Upon receipt of the JPSS Ground Contract, NOAA will revise the PEP and period specific goals to streamline and simplify oversight where possible. The formal revision will not occur until the next award fee period scheduled to begin February 1, 2019 as changes must occur before the next period.

Recommendation 8: Ensure that emphasis items (focus areas) provided to the contractor prior to each award period are clear, prioritized, and aligned with performance criteria.

NOAA Response to Recommendation 8: Concur. NOAA will further refine the period-specific goals and indicate, where possible, a mapping of how each objective relates to the PEP factors.

Recommendation 9: Ensure that the award fee determination process is adequately documented in accordance with the PEP and best practices.

NOAA Response to Recommendation 9: Concur. Upon receipt of the JPSS Ground Contract by NOAA, an additional role shall be added to the process for the explicit purpose of recording and documenting PEP activities. The Performance Evaluation Board (PEB) Chairperson will have the authority to designate who the recorder(s) shall be, and additional resources will be allocated to increase oversight. Further, a documentation process will be created to capture the notes and comments of the PEB to better articulate events and decision making processes that occurred leading up to the final determination

Recommendation 10: Ensure management controls are adequately integrated within the award fee determination process and that they are consistently implemented.

NOAA Response to Recommendation 10: Concur. Upon receipt of the JPSS Ground contract, NOAA will clarify and further define the roles and responsibilities contained within the PEP to ensure the integrity of the process is maintained. Training will be provided to all PEB members to ensure that the process is firmly understood and followed per the revised PEP. The Contracting Officer will also be involved in administration and oversight of the evaluation process by becoming a voting member of the PEB.

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