NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

Cost Estimates, Long-Term Savings, Milestones, and Enterprise Architecture Policy Are Needed for Common Satellite Ground System Program

FINAL REPORT NO. OIG-15-032-I
JUNE 11, 2015

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

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

June 11, 2015

MEMORANDUM FOR: Dr. Kathryn D. Sullivan
Under Secretary of Commerce for Oceans and Atmosphere
and NOAA Administrator

FROM: Allen Crawley
Assistant Inspector General for Systems Acquisition
and IT Security

SUBJECT: *Cost Estimates, Long-Term Savings, Milestones, and Enterprise Architecture Policy Are Needed for Common Satellite Ground System Program*—Final Report No. OIG-15-032-I

As approved in December 2014, language in House Report 113-448, "Commerce, Justice, Science, and Related Agencies Appropriations Bill, 2015," directed OIG to provide a report regarding NOAA's existing satellite ground infrastructure and NOAA's plans for implementing a common ground system architecture. Attached is our final report, which covers NOAA's efforts from June 2013 to April 2015 and its plans to implement the architecture in the future. Our objectives for this review were to determine (1) the progress of NOAA's planning efforts and milestones for implementing a common satellite ground system architecture (i.e., an enterprise architecture), and (2) whether NOAA's plans and efforts provide adequate consideration for system redundancy, security, and scalability.

We found the following:

- **Enterprise Architecture (EA) planning is underway, but cost estimates are needed to determine appropriate investment reviews and reporting.** The National Environmental Satellite, Data, and Information Service (NESDIS) began efforts to develop a ground system EA in FYs 2013 and 2014 but did not progress as far as intended due to lack of resources and support from its satellite programs. In January 2015, NESDIS established its EA program and a program office. Resource and program coordination issues have been resolved and the program appears to be on track to finalize EA plans by July 2016. However, the degree of investment oversight required is uncertain due to the lack of program cost estimates. NESDIS should estimate program costs based on a defined time frame and identify Office of Management and Budget, Department, and NOAA reporting and review requirements applicable to the cost estimate.
- **Planning is following best practices, but return on investment and plans and milestones beyond 2016 are yet to be determined.** NESDIS is following best practices and incorporating lessons learned from similar programs at other agencies. It expects that an enterprise approach for its ground systems will reduce costs and accelerate deployment of capabilities. However, it has not identified goals for cost

reduction or accelerated deployment; plans to reach these goals are also undetermined. As Ground Enterprise Architecture Services (GEARS) goals and plans are developed, NOAA should clearly and regularly report to Congress and other key stakeholders the progress made against these and other milestones.

- **NESDIS is mostly compliant with EA guidance, but improvements are needed to enhance institutional commitment, quality assurance, information sharing, and IT security planning.** NESDIS has fulfilled 22 of the 31 (71 percent) EA management and development criteria we assessed for our review. However, NESDIS needs to further involve leadership with GEARS by formal policy, planning, and training. NESDIS also needs to improve quality assurance through establishing an independent review team for GEARS. Additionally, information sharing should be improved through implementing EA tools. Finally, NESDIS needs to improve IT security planning by identifying how and when experts in IT security architecture will be involved.

We have summarized NOAA's response to our draft report and included its entire formal response as appendix D. The final report will be posted on OIG's website pursuant to section 8M of the Inspector General Act of 1978, as amended.

In accordance with Department Administrative Order 213-5, please provide us your action plan within 60 days of this memorandum. The plan should outline the actions you propose to take to address each recommendation.

Please direct any inquiries regarding this report to me at (202) 482-1855, or Fred Meny, Director, Satellites and Weather Systems, at (202) 482-1931, and refer to the report title in all correspondence.

Attachment

cc: VADM Michael S. Devany, Under Secretary for Operations, NOAA
Stephen Volz, Assistant Administrator, NESDIS, NOAA
Steven Petersen, Director, Office of Satellite Ground Services, NOAA
Greg Mandt, GOES-R System Program Director, NOAA
Harry Cikanek, JPSS Program Director, NOAA
Mack Cato, Director, Office of Audit and Information Management, NOAA

Report In Brief

JUNE 11, 2015

Background

To reduce costs and accelerate deployment of capabilities, NOAA is transitioning to an Enterprise Architecture (EA) approach for developing ground system capabilities supporting its environmental satellites.

NOAA's environmental satellite programs are managed by the National Environmental Satellite, Data, and Information Service (NESDIS). In collaboration with the National Aeronautics and Space Administration (NASA), NESDIS is responsible for seven major satellite programs with satellites that operate in geostationary, low-Earth (e.g., polar), and other orbits.

Why We Did This Review

As approved in December 2014, language in House Report 113-448, "Commerce, Justice, Science, and Related Agencies Appropriations Bill, 2015," directed OIG to report to Congress on NOAA's existing satellite ground infrastructure, as well as the agency's plans for implementing a common ground system architecture. It also specified that our report should review the adequacy of NOAA's planning efforts and milestones for achieving a common ground system and the adequacy of its planning with respect to system redundancy, security, and scalability.

Our objectives for this review were to determine (1) the progress of NOAA's planning efforts and milestones for implementing a common satellite ground system architecture (i.e., an EA), and (2) whether NOAA's plans and efforts provide adequate consideration for system redundancy, security, and scalability. Our review covered NOAA's efforts from June 2013 to April 2015 and its plans to implement the architecture in the future.

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

Cost Estimates, Long-Term Savings, Milestones, and Enterprise Architecture Policy Are Needed for Common Satellite Ground System Program

OIG-15-032-I

WHAT WE FOUND

We found that

EA planning is underway, but cost estimates are needed to determine appropriate investment reviews and reporting. NESDIS began efforts to develop a ground system EA in FYs 2013 and 2014, but it did not progress as far as intended due to lack of resources and support from its satellite programs. In January 2015, NESDIS established its EA program and a program office. Resource and program coordination issues have been resolved and the program appears to be on track to finalize EA plans by July 2016. However, the degree of investment oversight required is uncertain due to the lack of program cost estimates.

Planning is following best practices, but return on investment and plans and milestones beyond 2016 are yet to be determined. NESDIS is following best practices and incorporating lessons learned from similar programs at other agencies. It expects that taking an enterprise approach for its ground systems will reduce costs and accelerate deployment of capabilities. However, it has not identified goals for cost reduction or accelerated deployment and the plans to reach these goals are also undetermined. As Ground Enterprise Architecture Services (GEARS) goals and plans are developed, NOAA should clearly and regularly report to Congress and other key stakeholders the progress made against these and other milestones.

NESDIS is mostly compliant with EA guidance, but improvements are needed to enhance institutional commitment, quality assurance, information sharing, and IT security planning. NESDIS has fulfilled 22 (or 71 percent) of the 31 EA management and development criteria we assessed for our review. However, NESDIS needs to further involve leadership with GEARS by establishing formal policy, planning, and training. NESDIS also needs to improve quality assurance through establishing an independent review team for GEARS. Additionally, information sharing should be improved through implementing EA tools. Finally, NESDIS needs to improve IT security planning by identifying how and when experts in IT security architecture will be involved.

WHAT WE RECOMMEND

We recommend that the NOAA Administrator

1. Develop a GEARS program cost estimate based on a defined time frame.
2. Identify OMB, Department, and NOAA review and reporting requirements applicable to the program cost estimate.
3. Identify and regularly communicate anticipated GEARS return on investment, milestones, and performance measures to NOAA, the Department, and Congressional stakeholders.
4. Direct NESDIS to establish an EA policy.
5. Direct NESDIS to establish an executive committee with adequate experience and training to review GEARS technical implementation, and ensure its members are included in the development and approval of plans.
6. Establish an independent review team with adequate EA expertise to review GEARS.
7. Direct NESDIS to implement an EA repository during planning.
8. Direct NESDIS to identify methods and milestones for including IT security architects in GEARS development and determine milestones for management review of plans.
9. Direct NESDIS to identify IT security weaknesses in legacy systems to be integrated or replaced by GEARS and ensure mitigations are included in GEARS transition plans.

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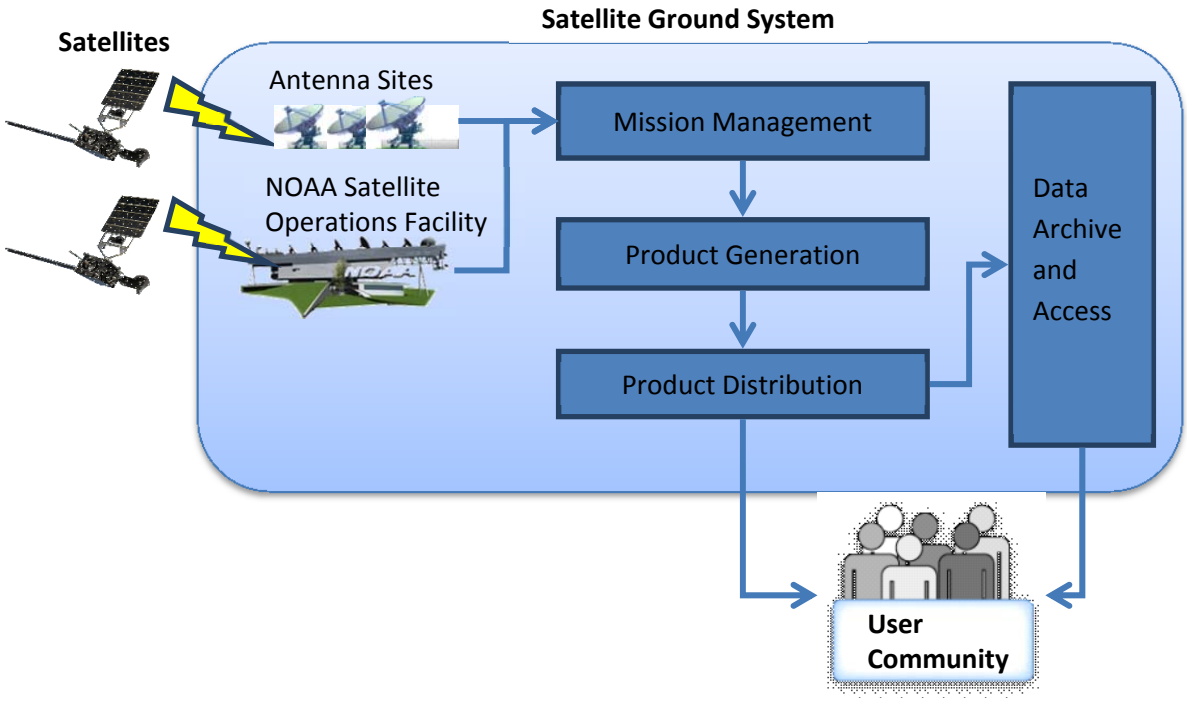
COVER: Detail of fisheries pediment, U.S. Department of Commerce headquarters, by sculptor James Earle Fraser, 1934

Introduction

To reduce costs and accelerate deployment of capabilities, the National Oceanic and Atmospheric Administration (NOAA) is transitioning to an Enterprise Architecture (EA) [1] approach for developing ground system capabilities supporting its environmental satellites. NOAA has defined the vision and overall approach for developing these enterprise capabilities, but long-term plans, costs, and return on investment are undetermined at this time. NOAA's environmental satellite programs are managed by the National Environmental Satellite, Data, and Information Service (NESDIS). NESDIS provides its users timely access to global environmental data from satellites and other sources to promote, protect, and enhance the nation's economy, security, environment, and quality of life.

Figure 1. Overview of NESDIS Environmental Satellite Ground Systems



Source: OIG adaption of NESDIS ground system documentation

In collaboration with the National Aeronautics and Space Administration (NASA), NESDIS is responsible for seven major satellite programs[2] with satellites that operate in geostationary, low-Earth (e.g., polar), and other orbits. NESDIS ground systems operate satellites, acquire their data, and provide environmental data products[3] via a core set of functional elements

[1] EAs are blueprints for optimizing performance of core business processes within an efficient information technology environment across multiple organizations, programs, and systems.

[2] See appendix B for an overview of NESDIS satellite programs.

[3] Environmental satellite data products are derived from raw data obtained by satellite sensors. NESDIS data products provide valuable information concerning the earth's atmosphere, oceans, land, and the space around it. Examples of these products include measurements of wind patterns and intensity, sea and lake ice, vegetation density, fire detection, and solar radiation.

(mission management, product generation, and product distribution, and data archive and access) to support the National Weather Service and other users[4] (see figure 1, previous page).

Historically, due to partnerships and acquisition strategies, the development of NESDIS' various ground systems tends to focus on meeting requirements unique to individual programs. In general, the systems that make up the existing infrastructure use dedicated components for each program and provide for limited sharing of common standards (e.g., product formats), services (e.g., system auditing, database management, and access control), or functions (e.g., mission management and product generation). Some capabilities of the existing infrastructure are shared among different satellite programs (see table 1, below). For instance, one of the largest programs, the Joint Polar Satellite System (JPSS), acquires and routes data for several different environmental satellite programs. Also, most NESDIS satellite data gathered by its ground systems are archived by a single system, the Comprehensive Large Array-data Stewardship System (CLASS).

Table 1. Matrix of Mission Functions Shared for NESDIS Satellite Programs

Satellite Program	Mission Management	Product Generation	Product Distribution	Data Archive and Access
Suomi National Polar-orbiting Partnership (S-NPP)[a]	U	U	U	S
Joint Polar Satellite System (JPSS)	U	PS	PS	S
Geostationary Operational Environmental Satellite R-Series (GOES-R)	U	U	PS	S
Polar-orbiting Operational Environmental Satellites (POES)	U	PS	PS	S
Geostationary Operational Environmental Satellite System (GOES)	U	PS	PS	PS
Deep Space Climate Observatory (DSCOVR)	U	U	U	U
Constellation Observing System for Meteorology, Ionosphere, and Climate (COSMIC)	PS	U	PS	U
Jason-2/Ocean Surface Topography Mission (OSTM)	U	U	PS	U

Source: Adapted by the OIG from NESDIS documentation
[a]The S-NPP mission is included in the JPSS program, but is listed separately because it has its own ground system.
U—mission functions are provided by capabilities unique to the program; PS—mission functions are partially provided by shared capabilities; S—mission functions are provided entirely from shared capabilities.

[4] These include international partners, other federal agencies, academic institutions, and the general public.

NOAA believes that its historical approach of developing program-specific ground systems resulted in redundant functionality and high operations and maintenance costs. It is currently planning to transition this infrastructure to an enterprise infrastructure that is expected to increase the sharing of common standards, services, and functions through a suite of common services. At this time, NOAA has not identified the total value of cost savings associated with this enterprise infrastructure.

Enterprise planning is still in the early stages. NESDIS has completed the foundation work of organizing a program office, initiating an EA program, and determining its approach and vision for the future enterprise ground system infrastructure. The program is now moving forward with its planning efforts, supported by fiscal year (FY) 2015 budget and FY 2016 budget request of $3.4 million and $4.4 million, respectively. NESDIS expects to finalize its EA plans and the roadmap for implementation by July 2016. Its long-term goal is to implement a full suite of enterprise ground capabilities by 2022 that will eliminate the need for NESDIS to acquire new stand-alone satellite ground systems.

A Large and Complex Infrastructure

- NESDIS provides full support for 11 satellites
- NESDIS partially supports or utilizes data from dozens of other satellites operated by NASA, the Department of Defense, and international partners and agencies
- 25 facilities provide functionality for NESDIS ground systems

Objectives, Findings, and Recommendations

Our objectives for this review were to determine (1) the progress of NOAA's planning efforts and milestones for implementing a common satellite ground system architecture (i.e., an enterprise architecture) and (2) whether NOAA's plans and efforts provide adequate consideration for system redundancy, security, and scalability. Our review covered NOAA's efforts from June 2013 to April 2015 and its plans to implement the architecture in the future. See appendix A for additional details concerning the objectives, scope, and methodology of our review.

We found that, despite a slow start, EA planning is now progressing—but NESDIS has not estimated program costs, and thus the degree of investment reporting and review are uncertain. Currently, NOAA's reports to Congress and the Department do not include important information such as short-term EA milestones or performance metrics. Also milestones, plans, and return on investment are still undetermined. In addition, we found that—while NESDIS leadership supports EA development—NESDIS lacks an EA policy, and leadership needs to be involved in an executive committee to guide the program and be trained in EA principles. We also found that additional attention is needed to provide adequate quality assurance and increased sharing of architecture information. Finally, although scalability, redundancy, and security requirements are adequate,[5] involvement of information technology (IT) security expertise needs to be ensured.

I. Enterprise Architecture Planning Is Underway, but Cost Estimates Are Needed to Determine Appropriate Investment Reviews and Reporting

NESDIS began efforts to develop a ground system EA in FYs 2013 and 2014, but it did not progress as far as intended due to lack of resources and support from its satellite programs. In January 2015, NESDIS established its EA program and a program office. Resource and program coordination issues have been resolved and the program appears to be on track to finalize EA plans by July 2016. However, the degree of investment oversight required is uncertain due to the lack of program cost estimates.

A. Slow Start for Enterprise Architecture Planning in FYs 2013 and 2014

NESDIS initiated planning of enterprise architecture for its ground systems in 2013 and continued through 2014. Only preliminary plans were created, however, which were not as mature as originally intended. The initial effort had limited funding ($0.5 million in FY 2013 and $1.5 million in FY 2014)[6] and access to subject matter experts on the GOES-R and JPSS ground projects (who were already fully engaged in the development

[5] NESDIS has not yet developed detailed or long-term architecture plans for scalability, redundancy, and IT security. We assessed high-level requirements for these elements and found them acceptable.

[6] FY 2014 enterprise architecture development was funded at $1.5 million out of a $3 million budget for the enterprise ground system. The remaining funds ($1.5 million) supported planning activities to establish the Office of Satellite Ground Services (OSGS).

of those projects). Further, the project's one full-time member, a technical leader, left unexpectedly in May 2014. The remainder of the team consisted of NESDIS staff that participated as part-time volunteers. Despite these challenges, the team developed, by the end of FY 2014, a vision for the EA and laid a foundation for further development.

B. *In Early 2015, NESDIS Reorganized and Established a Formal Program to Implement a Ground System Enterprise Architecture*

Building on lessons learned from its preliminary work, NESDIS established a more formal and organized approach to develop a ground system EA. In January 2015, it organized the Office of Satellite Ground Services (OSGS). The OSGS vision is to "create an integrated, cross-program, cross-NESDIS team creating and sustaining Ground Enterprise ARchitecture Services (GEARS)," the future NESDIS enterprise architecture. To fulfill this responsibility, the OSGS has a threefold mission to (1) sustain current ground system operations,[7] (2) enable future ground system operations,[8] and (3) create GEARS. By February 2015, OSGS had fully staffed its GEARS team. The team includes six full-time architects under the direction of a full-time chief ground systems architect. OSGS is working closely with the JPSS and GOES-R programs to ensure that support from subject matter experts will be available as needed. The GEARS team expects to finalize its architecture and implementation roadmaps by July 2016.

*High-Level Requirements for **G**round **E**nterprise **AR**chitecture **S**ervices (**GEARS**)*

- A wide range use of shared ground services that support continually available operational capabilities for controlling satellites and receiving, processing and distributing environmental data
- To maximize the use of existing NESDIS facilities and architecture while complying with federal, Departmental, and NOAA policies and standards

The majority of the OSGS budget ($50 million in FY 2015 and $59 million requested for FY 2016) is dedicated toward sustaining current ground system operations because of the critical need to keep these programs running. GEARS efforts—still in the early stages—have a much smaller budget ($3.4 million for FY 2015 and an estimated $4.4 million for FY 2016; see table 2, next page, for analysis of OSGS budget).

[7] Current operations include GOES, POES, and S-NPP.

[8] Future operations include GOES-R and JPSS.

Table 2. NESDIS Office of Satellite Ground Services: FY 2015 and FY 2016 Budget Summary (in $ millions)

OSGS Activities	FY 2015 Budget	FY 2016 Estimated Budget
Ground Enterprise ARchitecture Services (GEARS) architecture and prototyping	3.4	4.4
Sustainment of legacy program (e.g. POES and GOES) ground systems	10.5	10.5
Development of systems supporting the management and archive of environmental satellite data, and infrastructure redundancy for both legacy and next-generation programs	20.7	20.7
OSGS systems engineering, rent, salaries	13.3	20.9
NESDIS, NOAA, and Department taxes	2.1	2.5
Total	**50.0**	**59.0**

Source: OIG adaptation of OSGS budget documentation

C. Program Costs and Reporting Need to Be Determined

The Department's IT acquisition policy requires agencies to report status and performance of IT investments with life-cycle costs[9] of more than $10 million to the U.S. Office of Management and Budget (OMB)[10] for review. The Department's policy and a NOAA directive on IT investment authority require management review of investments over this same threshold. However, NESDIS has not determined what reporting or reviews will be performed for the GEARS program, because estimated costs of the program are undetermined. These costs cannot be calculated until the implementation roadmap for deploying a full suite of GEARS capabilities by the end of 2022 is further defined.

According to NESDIS, the GEARS program has no known end point because it is expected to provide ground system services for an indeterminate time. However, OMB guidance explains that "[a]ll IT investments should have a defined life cycle with start and end dates,"[11] and—even for investments for which end dates are not provided—OMB

[9] *Life cycle costs* are all investment costs from the commencement of an investment through its estimated useful life (or the composite useful life of the assets within the investment).

[10] A capital asset plan and business case summary must be submitted to the OMB for all major IT investments. Department of Commerce policy identifies major investments as those with estimated costs of more than $10 million.

[11] U.S. Executive Office of the President, Office of Management and Budget (OMB), July 1, 2013. *Guidance on Exhibits 53 and 300 – Information Technology and E-Government*, Washington, DC: OMB, 9.

has previously required that at least a time period for measuring costs be specified.[12] Until cost estimates based on start and end dates for the program are developed, mechanisms used by OMB, the Department, and NOAA to oversee IT investments will be undetermined. NESDIS should estimate GEARS costs based on a defined time frame. Once the architecture and implementation roadmaps are finalized, NESDIS should identify OMB, Department, and NOAA reporting and review requirements applicable to the program cost estimate.

II. Planning Is Following Best Practices, but Return on Investment and Plans and Milestones Beyond 2016 Are Yet to Be Determined

NESDIS is following best practices and incorporating lessons learned from similar programs at other agencies. It expects that taking an enterprise approach for its ground systems will reduce costs and accelerate deployment of capabilities. However, it has not identified goals for cost reduction or accelerated deployment and the plans to reach these goals are also undetermined. As GEARS goals and plans are developed, NOAA should clearly and regularly report to Congress and other key stakeholders the progress made against these and other milestones.

GEARS EA Principles

- Reduce costs while maintaining value.
- Common services are preferred over unique or duplicative services.
- Information is shared across the enterprise.
- Services are independent of specific technologies so they can operate on a variety of technology platforms.
- Use of diverse technologies is minimized.
- Software, hardware interoperability.

A. Development Is Based on Enterprise Architecture Principles and Best Practices

NESDIS is basing GEARS development upon EA principles that align with those recommended by OMB.[13] These principles promote the sharing of common resources and capabilities that are currently duplicated by increasing the interoperability and flexibility of systems. NESDIS aims to establish a common baseline of ground system services that the different programs can draw upon.

To further manage its EA efforts, NESDIS is following a best practice known as the Architecture Development Method (ADM),[14] a nine-phase process that begins with generic concepts and moves to a specific, physical[15] architecture to be deployed. NESDIS has completed the early stages of the ADM, in which preliminary steps to initiate the effort are taken and the EA vision is defined. It has only recently started the

[12] OMB, 2011. *Guidance on Exhibit 300—Planning, Budgeting, Acquisition, and Management of IT Capital Assets*, Washington, DC: OMB, 13–14.

[13] OMB, May 2, 2012. *The Common Approach to Federal Enterprise Architecture*, Washington, DC: OMB, 13–14.

[14] See page 10 of The Open Group, 2011, *Open Group Standard: The Open Group Architecture Framework (TOGAF®) Version 9.1*.

[15] *Physical architecture plans* include descriptions of real-world entities (e.g. servers, workstations, and network equipment) needed to implement components of the enterprise architecture.

remaining phases, in which the EA is designed, opportunities for improvements are identified, and implementation plans are created. As a result, NESDIS has not yet identified longer-term goals, milestones, and detailed plans for its GEARS program.

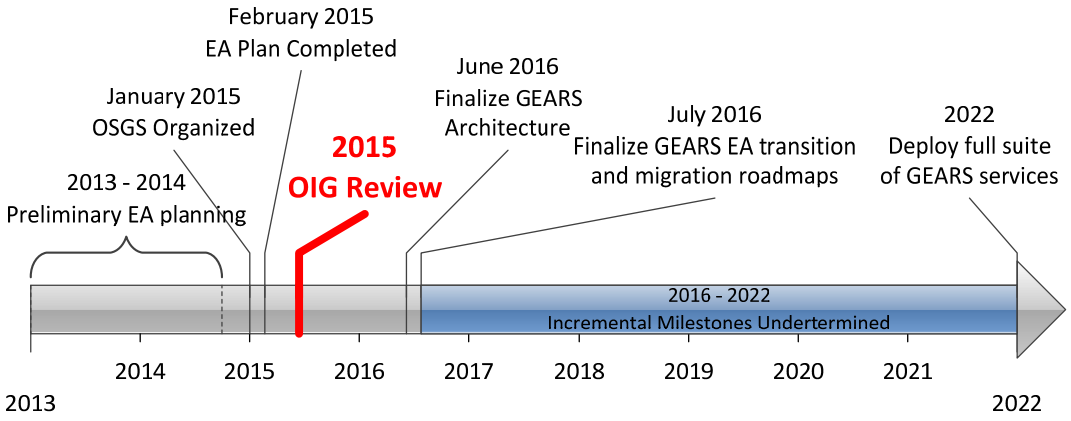
B. *Long-Term Return on Investment Is Not Yet Determined*

NESDIS does not yet have sufficient information to determine its goals for long-term return on investment of the GEARS program. However, NESDIS has identified preliminary opportunities to avoid costs by applying EA principles to its current systems and programs. Some examples include (1) eliminating redundant data products, (2) using shared systems and network infrastructure to distribute environmental satellite products, and (3) compressing data to reduce hardware and software requirements. According to NESDIS, these preliminary opportunities may initially avoid costs of $19.2 million and avoid ongoing costs of $580,000 per year. NESDIS is still exploring these preliminary opportunities and has not yet determined whether it will implement all of them. Studies are also underway to determine further opportunities for cost avoidance.

C. *Implementation Milestones and Plans Beyond 2016 Are Not Yet Determined*

Milestones for reaching the NESDIS goal of deploying a full suite of satellite ground services by 2022 will not be determined until the GEARS EA team completes further phases of the ADM. By July of 2016, NESDIS expects that transition and migration roadmaps will be developed that define how to implement the EA through incremental evolution of the existing ground systems (see figure 2).

Figure 2. Timeline of GEARS Progress and Milestones



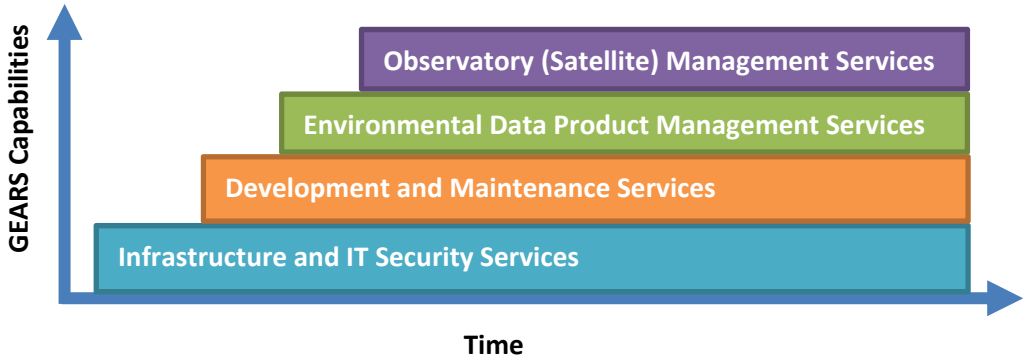
Source: OIG adaption of OSGS planning documentation

NESDIS has defined high-level concepts of its overall approach toward implementing GEARS—with capabilities to the ground system infrastructure developed incrementally. The content and sequence of the capabilities added in each increment will be driven by return on investment analysis and mission and engineering constraints (foremost among which is NOAA's commitment that GEARS will not delay satellite launches of the

GOES-R series, or the JPSS-1 and JPSS-2 missions). According to NESDIS, GEARS capabilities will grow over time to be an increasing portion of the NESDIS ground systems as legacy capabilities are phased out.

NESDIS applied lessons learned from other agencies[16] undertaking similar efforts in order to determine the best approach for GEARS. A key recommendation from this exercise was to use an incremental approach that begins with developing capabilities in areas that are simpler and where missions and systems are most common (e.g., information systems infrastructure, IT security, and data product management). Afterward, more complex capabilities that are more mission- and system-specific, such as managing satellite operations, can be undertaken. See figure 3 for an example of this approach.

Figure 3. Example of Possible Deployment of GEARS Increments Over Time



Source: OIG adaptation from GEARS program documentation

D. *Progress, Plans, and Performance Need to Be Regularly Reported to Key Stakeholders*

NOAA's recent quarterly reports to the Department (February 2015) and Congress (March 2015) reported "[f]uture enterprise system architecture analysis and transition planning underway" but did not discuss current milestones for developing the planned architecture and implementation roadmap, GEARS budget, or performance. OMB guidance[17] specifies that the primary outcome of defining and planning an EA should provide that

> [l]eadership and stakeholders will possess an integrated set of plans and artifacts defining what will be done, when it will be done, what benefits will be achieved and when, and an estimate of cost. This set of plans should be synthesized into discrete decision-making packages for leadership and governance that are appropriate given financial, political, and organizational constraints.

[16] Other agencies include the National Reconnaissance Office and the U.S. Air Force Space and Missile Systems Center.

[17] See OMB, *The Common Approach to Federal Enterprise Architecture*, 20.

Although long-term plans and return on investment are undetermined at this time, NESDIS will need to ensure that as GEARS develops, clear and regular reporting of the program's plans, return on investment, and performance metrics are provided to NOAA, Departmental, and Congressional leadership.

III. NESDIS Is Mostly Compliant with Enterprise Architecture Guidance, but Improvements Are Needed to Enhance Institutional Commitment, Quality Assurance, Information Sharing, and IT Security Planning

NESDIS has fulfilled 22 of the 31 (71 percent) EA management and development criteria we assessed[18] for our review (see appendix C for the detailed results of our assessment). However, NESDIS needs to further involve leadership with GEARS by establishing formal policy, planning, and training. NESDIS also needs to improve quality assurance through establishing an independent review team for GEARS. Additionally, information sharing should be improved through implementing EA tools. Finally, NESDIS needs to improve IT security planning by identifying how and when experts in IT security architecture will be involved.

A. An Enterprise Architecture Policy, Formal Training, and an Executive Committee Should Be Established

By establishing the OSGS with responsibility for existing and future ground systems operation, sustainment, and development[19] NESDIS leadership has structured the organization for an eventual transition to GEARS. OSGS is working with next-generation satellite programs[20] to coordinate current ground systems development with the GEARS program. Long-term commitment and coordination of leadership is important to overcoming barriers to success. Such commitment would be further assured by NESDIS taking additional steps—including defining an EA policy approved by the assistant administrator and establishing a GEARS executive committee that has been trained in EA principles and is involved in GEARS planning.

According to Government Accountability Office (GAO) guidance[21] for EA management, NESDIS should have a documented policy, approved by the organization head, to institutionalize the architecture's importance, role, and relationship to other corporate management disciplines. OSGS has developed various plans for EA, which include some elements of an EA policy. However, these plans—not yet approved by the NESDIS assistant administrator—do not carry the authority of NESDIS policy. Without a formal

[18] We assessed criteria from the ADM and federal EA guidance NESDIS has selected to follow for GEARS development.

[19] With the exception of some elements of the JPSS Common Ground System which are being acquired and developed by NASA, these elements will be transferred to OSGS responsibility one year after launch of the JPSS-1 satellite, which is planned for launch no later than the second quarter of FY 2017.

[20] Next-generation programs include GOES-R and JPSS.

[21] U.S. Government Accountability Office, August 2010. *Organizational Transformation, A Framework for Assessing and Improving Enterprise Architecture Management (Version 2.0)*, GAO-10-846G. Washington, DC: GAO.

and approved EA policy, commitment and cooperation to implement GEARS may diminish as time passes and complexity, obstacles, and competing priorities arise.

A recommended practice for involving organization leaders is through the formation of an executive committee[22] to govern the effort and to establish enterprise-wide responsibility and accountability. The committee should be trained in EA principles and concepts to effectively execute its roles and responsibilities. While OSGS has created plans for an executive committee, identified as the "GEARS board," and identified its potential membership, it has not yet implemented those plans. NESDIS has indicated that additional plans for the GEARS board are in development, but it currently does not have plans to train GEARS board members in EA principles and concepts. We also found that OSGS has drafted communication[23] and governance[24] plans in which NESDIS executive leadership have key roles, but has not yet vetted the plans with those leaders. To ensure that organization leaders are adequately involved and committed to EA, NESDIS must (1) establish an EA policy applicable to GEARS, (2) implement an executive committee and ensure its members are trained in EA principles and concepts, and (3) ensure that committee members are included in development and approval of GEARS plans.

B. Periodic Expert Reviews to Promote Quality Assurance Should Be Established

Periodic reviews should be performed by internal and external experts to ensure that proper EA methods are being followed, information is accurate, and value is provided. We found that the GEARS program is planning to assess the maturity of its EA program on an ongoing basis, but it has not yet established the capacity for periodic independent reviews. Traditionally, NOAA satellite programs have been reviewed by teams with expertise in satellite technology, systems engineering, and other disciplines.

NESDIS determined that GEARS will need a review team with a different set of expertise in systems architecture; therefore, an appropriate review team could not be readily assembled for GEARS. NESDIS is currently in the process of determining by whom and how these reviews will be performed. Until NESDIS implements regular independent expert reviews, it will lack the valuable insight and recommendations that such reviews are able to provide. NESDIS will need to ensure that an independent review team with adequate expertise is assembled. The review team needs to be tasked with ensuring that proper methods are followed, information is accurate, and GEARS is providing value to NOAA.

[22] The committee should be composed of executive-level representatives from lines of business associated with ground system capabilities.

[23] A *communication plan* identifies the communication needs, methods, and frequency for communicating EA information to its stakeholders.

[24] *Governance plans* identify the planning, decision-making, and oversight processes and groups that will determine how an EA is developed, used, and sustained over time.

C. *A Repository to Manage and Share Enterprise Architecture Artifacts Is Needed*

Enterprise architecture tools should be implemented during the preliminary phase of EA development. One important tool is an EA repository that provides a single place for the storage and retrieval of architecture artifacts. The repository allows projects to manage their deliverables, locate re-useable assets, and publish architecture development output to stakeholders and other interested parties. We found that NESDIS is still in the process of procuring EA tools that provide the functionality to implement an EA repository (NESDIS expected procurement to be completed in May 2015). Until an EA repository is implemented, it will be more challenging for the GEARS program to effectively share information internally and externally concerning the existing ground system infrastructure and its plans to implement GEARS. NESDIS will need to ensure that once EA tools are procured, an EA repository is implemented and used effectively.

D. *Enterprise Architecture Plans Need to Include IT Security Architecture Experts and Reviews*

We found that high-level requirements for scalability, redundancy, and IT security are adequate. However, current EA plans do not define the timetable and manner for including an IT security architect in EA development or when IT security-related aspects of the architecture will be reviewed or approved. The plans do specify that an IT security architect will be involved; and an IT security architect has been assigned to the team. The plans for including the IT security architect and milestones for management sign-off on IT security related aspects of the architecture should be defined. If GEARS development continues without making these determinations, the IT security aspects of the architecture may not be sufficiently addressed.

We also found that NESDIS has struggled to implement sufficient IT security when integrating legacy and replacement systems. In 2008,[25] we found significant IT security concerns that had been ongoing for several years in NESDIS's Satellite Environmental Processing System (SATEPS). SATEPS was decommissioned and its components integrated with the replacement Environmental Satellite Processing Center (ESPC) system. In 2009,[26] we found that ESPC had serious IT security deficiencies resulting from a lack of fundamental IT security planning. And in 2014, we found similar circumstances with the JPSS ground system.[27] It contained numerous IT security weaknesses inherited from its predecessor program, the National Polar-orbiting Operational Environmental Satellite System. OIG assessments of ESPC, GOES, POES, and other critical NESDIS systems also found significant IT security issues.[28] In the future, GEARS will perform

[25] See U.S. Department of Commerce Office of Inspector General, September 2008. *FY 2008 FISMA Assessment of Satellite Environmental Processing System* (NOAA5035), OSE-19167. Washington, DC: DOC OIG.

[26] See DOC OIG, January 2010, *FY 2009 FISMA Assessment of the Environmental Satellite Processing Center (NOAA5045)*, OAE-19730. Washington, DC: DOC OIG.

[27] See DOC OIG, August 21, 2014, *Expedited Efforts Needed to Remediate High-Risk Vulnerabilities in the Joint Polar Satellite System's Ground System—Final Memorandum*, OIG-14-027-M. Washington, DC: DOC OIG.

[28] See DOC OIG, July 15, 2014, *Significant Security Deficiencies in NOAA's Information Systems Create Risks in Its National Critical Mission,* OIG-14-025-A. Washington, DC: DOC OIG.

functions now filled by ESPC and other legacy systems; thus, GEARS could be exposed to those weaknesses. NESDIS needs to identify the specific IT security weaknesses in legacy systems that will be integrated or replaced by GEARS and ensure mitigations for those weaknesses are included in GEARS transition plans.

Recommendations

We recommend that the NOAA Administrator

1. Develop a GEARS program cost estimate based on a defined time frame.
2. Identify OMB, Department, and NOAA review and reporting requirements applicable to the program cost estimate.
3. Identify and regularly communicate anticipated GEARS return on investment, milestones, and performance measures to NOAA, the Department, and Congressional stakeholders.
4. Direct NESDIS to establish an enterprise architecture policy.
5. Direct NESDIS to establish an executive committee experienced in ground system architecture to review GEARS technical implementation—and ensure its members are trained in the principles and concepts of EA, as well as included in the development and approval of plans.
6. Establish an independent review team with adequate EA expertise to review GEARS and confirm that proper methods are followed, information is accurate, and value to NOAA is provided.
7. Direct NESDIS to implement an EA repository to share access to artifacts and improve coordination during planning.
8. Direct NESDIS to identify methods and milestones for including IT security architects in GEARS development and determine milestones for management review of IT security architecture plans.
9. Direct NESDIS to identify IT security weaknesses in legacy systems to be integrated or replaced by GEARS and ensure mitigations for those weaknesses are included in GEARS transition plans.

Summary of Agency Response and OIG Comments

In response to our draft report, NOAA concurred with all of our recommendations and did not provide any recommended changes for factual or technical information. NOAA suggested alternative wording for recommendation 5 to better align this recommendation with the governance structure planned for GEARS. We modified recommendation 5 accordingly. NOAA's formal response appears in appendix D of this report.

Appendix A: Objectives, Scope, and Methodology

As approved in December 2014, language in House Report 113-448, "Commerce, Justice, Science, and Related Agencies Appropriations Bill, 2015," directed OIG to provide a report regarding NOAA's existing satellite ground infrastructure and NOAA's plans for implementing a common ground system architecture. It also specified that our report should include a review regarding the adequacy of NOAA's planning efforts and milestones for achieving a common ground system and the adequacy of its planning with respect to system redundancy, security, and scalability. This review was initiated in January 2015, with fieldwork ending in April 2015. Our objectives were to determine

1. the progress of NOAA's planning efforts and milestones for implementing a common ground system architecture, and

2. whether NOAA's plans and efforts provide adequate consideration for system redundancy, security, and scalability.

To accomplish our objectives, we interviewed members of the architecture team, OSGS leadership, and program managers and directors from the offices and programs involved with and affected by the GEARS program including GOES-R and JPSS program directors, NASA and NOAA ground project managers, and other directors in NESDIS. We examined program activities and documentation supporting progress and planned activities and compared them with the following standards and best practices:

- *Department of Commerce Enterprise Architecture Policy*, version 2.0, July 30, 2007

- *The Common Approach to Federal Enterprise Architecture*, May 2, 2012

- *The Open Group Architecture Framework* (*TOGAF*®), Version 9.1, 2011

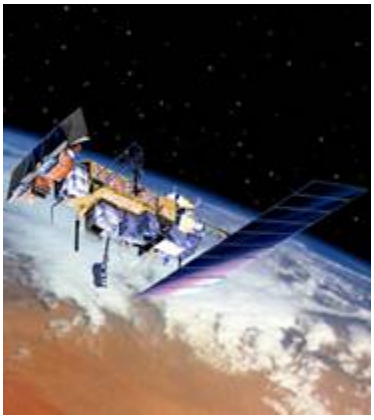
- *GAO Organizational Transformation, A Framework for Assessing and Improving Enterprise Architecture Management (Version 2.0),* GAO-10-846G, August 2010

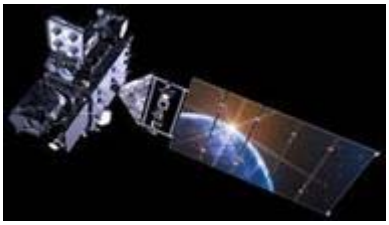
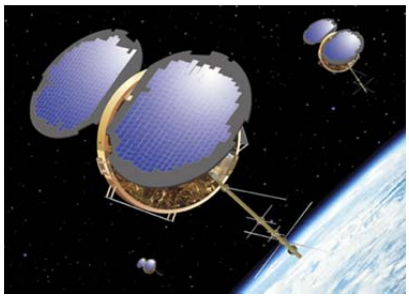
- *Joint Task Force Transformation Initiative: Security and Privacy Controls for Federal Information Systems and Organizations,* NIST Special Publication 800-53 Rev. 4, April 2013

- *Guide to Industrial Control Systems (ICS) Security,* NIST Special Publication 800-82, June 2011

We conducted our review under the authority of the Inspector General Act of 1978, as amended, and Department Organizational Order 10-13, dated April 26, 2013. We conducted the evaluation in accordance with Quality Standards for Inspection and Evaluation, January 2012, issued by the Council of Inspectors General on Integrity and Efficiency.

Appendix B: Overview of NESDIS Satellite Programs

Program	Description of Program
Polar-orbiting Operational Environmental Satellites (POES) 	The POES satellite system provides visible, infrared, and microwave data for a variety of applications such as cloud and precipitation monitoring, determination of surface properties, and humidity profiles. POES makes polar orbits 14 times per day, approximately 520 miles above the surface of the Earth, allowing daily global coverage. The first satellite of the system was launched in April 1960 and consists today of five operational satellites.
Geostationary Operational Environmental Satellites (GOES) 	The GOES satellite system is positioned in a geosynchronous orbit about 22,300 miles above the earth. The first satellite of the GOES system was launched in December 1966 and now consists of three operational satellites. GOES provides atmospheric triggers for severe weather conditions such as tornadoes, flash floods, hail storms, and hurricanes. The satellite imagery is also used to estimate rainfall during thunderstorms and hurricanes for flash flood warnings, as well as to estimate snowfall accumulations and overall extent of snow cover.
Jason-2/Ocean Surface Topography Mission (OSTM) 	The Jason-2/OSTM is a follow-on satellite to the Jason-1 launched in June 2008. Jason-2 makes a circular non-sun-synchronous orbit with a 9.9-day repeat observation cycle, about 830 miles above the earth. The Jason-2 has several onboard instruments that provide information on the topography of the surface of the ocean. The main instrument is a radar altimeter that maps sea surface height in order to determine global sea-level rise, ocean currents, wind speed, ocean circulation, and other ocean-related altimetry products. Jason-2 will be succeeded by Jason-3, which is scheduled for launch in July 2015.

Program	Description of Program
Joint Polar Satellite System (JPSS) 	The JPSS provides operational continuity by replacing the POES satellite system making the same polar orbits 14 times per day. The first satellite launched in October 2011; the second will launch in early 2017. The JPSS gathers global measurements of atmospheric, terrestrial, and oceanic conditions, including sea and land surface temperatures, vegetation, clouds, rainfall, snow and ice cover, fire locations and smoke plumes, atmospheric temperature, water vapor, and ozone.
Geostationary Operational Environmental Satellites–R Series (GOES-R) 	GOES-R—the next generation of geostationary weather satellites replacing the GOES system—will provide continuous imagery and atmospheric measurements of Earth's Western Hemisphere and space weather monitoring. The first satellite is scheduled for launch in March 2016.
Deep Space Climate Observatory (DSCOVR) 	DSCOVR will succeed NASA's Advanced Composition Explorer's role in supporting solar wind alerts and warnings. The satellite will be positioned at the L1 orbit, the neutral gravity point between the Earth and sun approximately 1 million miles from Earth. DSCOVR was launched on February 11, 2015, and is expected to reach its L1 designation around the beginning of June 2015.
Constellation Observing System for Meteorology, Ionosphere, and Climate (COSMIC) 	The COSMIC-1 constellation of six satellites was launched in April 2006. The COSMIC system provides data including electron counts in the ionosphere and atmospheric soundings of temperature, moisture, and pressure in the troposphere and stratosphere. COSMIC-1 design life was reached in April 2011; one satellite has failed and two satellites are in degraded operation, leaving four of the original six satellites in operation. COSMIC-2 is a continuation to produce an operational constellation of 12 identical satellites; it is set to launch six satellites into low-inclination orbits in late 2015 and another six satellites into high-inclination orbits in early 2018.

Source: NESDIS and NASA satellite program information

Appendix C: NESDIS Compliance with Its Selected Guidance for Enterprise Architecture

We assessed NESDIS compliance with EA criteria from guidance it selected as it developed GEARS. Specifically, NESDIS is following the TOGAF Architecture Development Method (ADM) and the OMB Collaborative Planning Methodology (CPM) to guide its EA methodology, as well as the GAO Enterprise Architecture Management Maturity Framework (EAMMF) to perform ongoing assessments of the maturity of its efforts.

We only assessed criteria from the guidance for the phases, steps, or stages of EA development that are consistent with the progress achieved on the GEARS program at the conclusion of our fieldwork in April 2015. Specifically, we assessed criteria from

1. TOGAF ADM steps from the preliminary and architecture visions phases;[29]
2. OMB CPM steps (1) identify and validate, and (2) research and leverage;[30] and
3. GAO EAMMF core elements from maturity stages (1) establishing EA intuitional commitment and direction, and (2) creating the management foundation for EA development and use.[31]

We found that of the 31 criteria we assessed NESDIS is compliant with 22 (71 percent). Detailed results of our assessment are represented in the checklist below.

[29] See The Open Group, *Open Group Standard: TOGAF Version 9.1*, 57–78 and 199–208.

[30] See OMB, *The Common Approach to Federal Enterprise Architecture*, 15–19.

[31] See GAO, GAO-10-846G, 45-59.

Category	Criteria	Source			OIG Assessment of NESDIS Compliance
		ADM	CPM	EAMMF	
Architecture Vision and Concepts	Develop architecture vision	•		•	✓
	Define scope and organizations impacted	•			✓
	Identify stakeholders, concerns, and business requirements	•	•		✓
	Confirm and elaborate business goals, business drivers, and constraints	•			✓
	Evaluate business capabilities	•			✓
	Identify internal and external organizations or service providers with similar needs and leverage their results and experiences		•		✓
	Define the target architecture value propositions and key performance indicators (KPIs) or metrics	•	•	•	Not compliant: key performance indicators or metrics have not been defined for the program
	Assess readiness for business transformation	•			✓
	Define the required IT security capability as part of architecture capability	•			✓
	Determine and document the criticality of the system	•			✓
	Identify the business transformation risks and mitigation activities	•			✓
	Identify and document the anticipated physical/business/regulatory environment in which the system will be deployed	•			✓
Program Development	Defined and establish enterprise architecture team and organization/program office[a]	•		•	✓
	EA program management plan exists and reflects relationships with other management disciplines			•	✓
	Establish architecture project	•			✓
	Program office readiness is measured and reported			•	✓
Architecture Development	Identify and establish architecture principles	•			✓
	EA development and maintenance methodology exists			•	✓
	Prepare and adopt selected architecture framework	•		•	✓

Category	Criteria	Source			OIG Assessment of NESDIS Compliance
		ADM	CPM	EAMMF	
	Develop statement of architecture work and secure approval	•		•	Partially compliant: EA plan and schedule have been created, but not approved by the NESDIS Assistant Administrator
	Implement architecture tools	•		•	Not compliant: EA tools are not yet implemented, but are in progress
	Architecture segments are identified and prioritized			•	✓
	Obtain management support for IT security measures	•			✓
	Define necessary IT security-related management sign-off milestones of the architecture development cycle	•			Not compliant: IT security related milestones for management sign-off and IT security architect involvement are not defined
Governance, Management, and Policy	Written and approved organization policy exists for EA development, maintenance, and use			•	Not compliant: An EA policy has not been developed and approved
	Identify, confirm, and engage appropriate governance	•	•		Not compliant: An independent review team has not been established
	Executive committee representing the enterprise exists and is responsible and accountable for EA			•	Not compliant: An executive committee has not been established, but is in progress

Category	Criteria	Source			OIG Assessment of NESDIS Compliance
		ADM	CPM	EAMMF	
	Executive committee is taking proactive steps to address EA cultural barriers			•	Not compliant: An executive committee has not been established, but is in progress
	Executive committee members are trained in EA principles and concepts			•	Not compliant: An executive committee has not been established, but is in progress. Training for the committee is not planned
	Determine and document applicable disaster recovery or business continuity plans/requirements	•			✓
	Define and document applicable regulatory and security policy requirements	•			✓

[a] GAO EAMMF core elements 5 and 9–12 are grouped under this criterion and each was assessed. These criteria include: (5) chief architect exists, (9) EA budgetary needs are justified and funded, (10) EA program office exists, (11) key program office leadership positions are filled, and (12) program office human capital plan exists.

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

JUN 0 3 2015

MEMORANDUM FOR: Allen Crawley
Assistant Inspector General for Systems Acquisition
and IT Security

FROM: VADM Michael S. Devany
Deputy Under Secretary for Operations

SUBJECT: *Cost Estimates, Long-Term Savings, Milestones, and Enterprise Architecture Policy Are Needed for Common Satellite Ground System Program*
Draft OIG Audit Report

Thank you for the opportunity to comment on the Office of the Inspector General's draft audit report evaluating NOAA's plans for implementing a common ground system architecture. We agree with all nine recommendations and our response highlights completed and ongoing actions to address recommendations.

Our specific comments on the report's findings and recommendations are attached.

Attachment

Department of Commerce
National Oceanic and Atmospheric Administration
Comments to the OIG Draft Report Entitled
"Cost Estimates, Long-Term Savings, Milestones, and Enterprise Architecture Policy Are Needed for Common Satellite Ground System Program"

General Comments

The National Oceanic and Atmospheric Administration (NOAA) appreciates the opportunity to review the Office of the Inspector General (OIG) draft report. In general, NOAA agrees with the OIG conclusions and recommendations. The report accurately reflects the status for the Ground Enterprise ARchitecture Services (GEARS) in an organization that was established five months ago.

Recommended Changes for Factual/Technical Information

None.

Editorial Comments

On page 3, the OIG correctly states that the National Environmental Satellite, Data, and Information Service (NESDIS) "long-term goal is to implement a full suite of enterprise ground capabilities by 2022 that will eliminate the need for NESDIS to acquire new stand-alone satellite ground systems." NESDIS believes it would be helpful to note in the report that achievement of the 2022 GEARS goal is dependent on sufficient funding and ability to commit needed resources.

NOAA Response to OIG Recommendations

Recommendation 1: "We recommend that the NOAA Administrator develop a GEARS program cost estimate based on a defined time frame."

NOAA Response: Concur. The Office of Satellite Ground Services (OSGS) is conducting architecture studies and system engineering analysis supporting development and deployment of GEARS. The architecture team will deliver a draft transition plan in November 2015 and a final in July 2016. System engineering activities assessing opportunities to transition individual elements of the overall architecture into operation have begun and will continue through the next 18 months in parallel with the architecture work.

In the fall of 2015, NESDIS will engage a cost estimating team to assist in formulation activities supporting GEARS for a possible fiscal year (FY) 2018 start date. It is anticipated that GEARS will evolve as a series of quantified investments over time culminating in full deployment of enterprise services. Specific capabilities and associated cost efficiencies are to be determined in coming months.

Recommendation 2: "We recommend that the NOAA Administrator identify OMB, Department, and NOAA review and reporting requirements applicable to the program cost estimate."

NOAA Response: Concur. OSGS now briefs the NOAA Program Management Council every month on its Ground Enterprise activities. As GEARS investment projects are undertaken, OSGS will manage them in accordance with NESDIS, NOAA and Department directives, and comply with applicable OMB, Department, and NOAA review and reporting requirements.

Recommendation 3: "We recommend that the NOAA Administrator identify and regularly communicate anticipated GEARS return on investment, milestones, and performance measures to NOAA, Department and Congressional stakeholders."

NOAA Response: Concur. OSGS has made the GEARS Concept of Operations and the Enterprise Architecture (EA) plan widely available. As GEARS moves forward, OSGS will define return on investment, milestones, and performance measures with increased fidelity. These will also be widely shared with stakeholders, including those at NOAA, DOC, and Congress.

Recommendation 4: "We recommend that the NOAA Administrator direct NESDIS to establish an enterprise architecture policy."

NOAA Response: Concur. OSGS is following government and industry best practices in the development of GEARS. This includes the use of The Open Group Architecture Framework (TOGAF) architecture development model. Additionally, OSGS will follow DOC information technology (IT) Portfolio Management Policies and Directives as it defines investments under the GEARS Program. NESDIS will establish an enterprise architecture policy, including definition of how GEARS interacts with other elements of the NESDIS observing systems.

Recommendation 5: "We recommend that the NOAA Administrator direct NESDIS to establish an executive committee to lead and direct GEARS, ensure its members are trained in enterprise architecture principles and concepts, and be included in the development and approval of plans."

NOAA Response: We concur with the establishment of a GEARS Executive Committee. However, the GEARS Program is led by the GEARS Program Manager, who receives direction from the OSGS Director. The GEARS program budget is approved through the existing NESDIS process led by the Assistant Administrator. Subsequently, we recommend the following language for this recommendation:

The governance construct defined in the GEARS Concept of Operations is consistent with this OIG recommendation (as revised). The GEARS Executive Committee, chaired by the Directors of OSGS and Office of Satellite and Product Operations, will kick-off no later than September 30, 2015, as defined in the February 2015 EA Plan. OSGS is planning and scheduling the initial meeting of the Executive Committee to support the FY 2018 budget formulation for GEARS.

Recommendation 6: "We recommend that the NOAA Administrator establish an independent review team with adequate enterprise architecture expertise to review GEARS and confirm that proper methods are followed, information is accurate, and value to NOAA is provided."

NOAA Response: Concur. An independent review team (IRT) has been part of the OSGS plans for GEARS from the start. At this time, OSGS is interviewing candidates for IRT membership who will provide a broad set of experiences and deep architectural expertise. We are looking to the deep skillsets and independence of Federally Funded Research and Development Centers. We are also exploring the inclusion of industry subject matter experts. We expect the IRT to conduct milestone (and intermediate level) independent reviews. It is intended these reviews will initially focus on technical design risks.

Recommendation 7: "We recommend that the NOAA Administrator direct NESDIS to implement an EA repository to share access to artifacts and improve coordination during planning."

NOAA Response: Concur. NESDIS is procuring an EA repository tool. The procurement request was approved and the acquisition package is with the NESDIS Headquarters procurement official who will complete the procurement process and obtain the product and licenses.

Recommendation 8: "We recommend that the NOAA Administrator direct NESDIS to identify methods and milestones for including IT security architects in GEARS development and determine milestones for management review of IT security architecture plans."

NOAA Response: Concur. Five security architects are employed by NESDIS, including one assigned to OSGS. Architects from OSGS and NESDIS Chief Information Office helped develop the Concept of Operation and already participate in planning activities for GEARs formulation.

Recommendation 9: "We recommend that the NOAA Administrator direct NESDIS to identify IT security weaknesses in legacy systems to be integrated or replaced by GEARS and ensure mitigations for those weaknesses are included in GEARS transition plans. "

NOAA Response: Concur. Plans of Action and Milestones for legacy systems have already been established, and those that involve activities covered by GEARS will be addressed with funds requested for the GEARS Program.