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POLAR SATELLITES

NOAA Faces Challenges and Uncertainties that Could Affect the Availability of Critical Weather Data

Statement of David A. Powner
Director, Information Technology Management Issues

July 7, 2016

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GAO Highlights

Highlights of GAO-16-773T, a testimony before the Subcommittee on Environment, Committee on Science, Space, and Technology, House of Representatives

Why GAO Did This Study

Polar-orbiting satellites provide data that are essential to support weather observations and forecasts. NOAA is preparing to launch the second satellite in the JPSS program in March 2017, but a near-term gap in polar satellite coverage remains likely. Given the criticality of satellite data to weather forecasts and the potential impact of a satellite data gap, GAO added this area to its High-Risk List in 2013.

This statement addresses the status of the JPSS program and plans for future satellites, NOAA's efforts to depict and update satellite timelines, and the JPSS program's implementation of key information security protections. This statement is based on a May 2016 report on JPSS and a draft report on satellite timelines. To develop the draft report, GAO reviewed agency procedures for updating satellite timelines, compared timelines to best practices and agency documentation, and interviewed officials.

What GAO Recommends

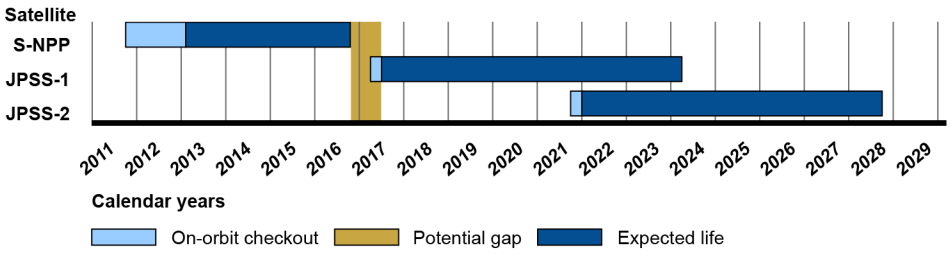
In its May 2016 report, GAO recommended that NOAA assess the costs and benefits of different launch decisions based on updated satellite life expectancies, and address deficiencies in its information security program. NOAA concurred with these recommendations. GAO's draft report includes recommendations to NOAA to improve the accuracy, consistency, and documentation supporting updates to satellite timelines, and to revise and finalize its draft policy governing timeline updates. This report is currently at the Department of Commerce for comment.

View GAO-16-773T. For more information, contact David A. Powner at (202) 512-9286 or pownerd@gao.gov

What GAO Found

As highlighted in a May 2016 report, the National Oceanic and Atmospheric Administration's (NOAA) Joint Polar Satellite System (JPSS) program has continued to make progress in developing the JPSS-1 satellite for a March 2017 launch. However, the program has experienced technical challenges which have resulted in delays in interim milestones. In addition, NOAA faces the potential for a near-term gap in satellite coverage of 8 months before the JPSS-1 satellite is launched and completes post-launch testing (see figure). NOAA has also begun planning for future polar satellites. However, uncertainties remained on the best timing for launching these satellites, in part because of the potential for some satellites already in orbit to last longer. NOAA did not provide sufficient evidence that it had evaluated the costs and benefits of launch scenarios for these new satellites based on updated life expectancies. Until this occurs, NOAA may not make the most efficient use of investments in the polar satellite program.

Timeline for a Potential Gap in Polar Satellite Data in the Afternoon Orbit



Source: GAO analysis based on National Oceanic and Atmospheric Administration and National Aeronautics and Space Administration data. | GAO-16-773T

Note: The afternoon orbit is one of three primary polar orbits providing needed coverage for numerical weather models.

As noted in a draft GAO report, NOAA publishes "flyout charts" depicting satellite timelines to support budget requests and appropriations discussions. The agency regularly updates its charts when key changes occur. However, the charts do not always accurately reflect data from other program documentation such as the latest satellite schedules or assessments of satellite availability. NOAA also has not consistently documented its justification for chart updates or depicted lifetimes for satellites beyond their design life, and has not finalized a policy for updating its charts. As a result, the information NOAA provides Congress on the flyout charts is not as accurate as it needs to be, which could result in less-than-optimal decisions.

GAO reported in May 2016 that, although NOAA has established information security policies in key areas recommended by guidance, the JPSS program has not yet fully implemented them. Specifically, while the program has implemented multiple relevant security controls, it has not yet fully implemented almost half of the recommended security controls, did not have all of the information it needed when assessing security controls, and has not addressed key vulnerabilities in a timely manner. Furthermore, NOAA has experienced 10 key information security incidents related to the JPSS ground system, including incidents regarding unauthorized access to web servers and computers. Until NOAA addresses these weaknesses, the JPSS ground system remains at high risk of compromise.

Chairman Bridenstine, Ranking Member Bonamici, and Members of the Subcommittee:

Thank you for the opportunity to participate in today's hearing on an important satellite acquisition program within the Department of Commerce's National Oceanic and Atmospheric Administration (NOAA). In 2010, NOAA initiated the Joint Polar Satellite System (JPSS) program with assistance from the National Aeronautics and Space Administration (NASA). NOAA launched the first satellite in the JPSS program in October 2011, and plans to launch the next satellite by March 2017. NOAA also plans to launch other similar satellites in the future.

The JPSS program is critical to the United States' ability to maintain the continuity of data required for weather forecasting. According to officials at NOAA, a gap in polar satellite data would result in less accurate and timely weather forecasts and warnings of extreme events, such as hurricanes, storm surges, and floods. Such degradation in forecasts and warnings would place lives, property, and our nation's critical infrastructures in danger. Given the criticality of satellite data to weather forecasts, the possibility of a satellite data gap, and the potential impact of a gap, we added this area to our High-Risk List in 2013 and it remained on the High-Risk List in 2015.[1]

This statement summarizes a recently issued report and key findings from a draft report on (1) the status of the JPSS program and plans for future satellites, (2) NOAA's efforts to depict and update satellite timelines; and (3) the JPSS program's implementation of key information security protections. Specifically, this statement is based on a May 2016 report detailing NOAA's progress on the JPSS satellite program with respect to schedule and key risks, its efforts to plan and implement a follow-on polar satellite program, and the JPSS program's implementation of key

[1]Every 2 years, at the start of a new Congress, we call attention to agencies and program areas that are high risk due to their vulnerabilities to fraud, waste, abuse, and mismanagement, or are most in need of transformation. See GAO, *High Risk Series: An Update*, GAO-13-283 (Washington, D.C.: Feb. 14, 2013) and *High Risk Series: An Update*, GAO-15-290 (Washington, D.C.: Feb. 11, 2015).

information security protections.[2] More detailed information on our objectives, scope, and methodology can be found in the issued report.

This statement is also based on a draft report that includes the results of work we performed for the House Committee on Appropriations for information on NOAA's efforts to depict and update polar satellite timeline information. For our draft report, we reviewed NOAA policies, procedures, and documentation on recent updates to its satellite timelines, compared the timeline updates to other agency documentation and support materials, and interviewed agency officials. We reviewed information from the draft report with agency officials and made technical changes as appropriate. This draft report is currently at the Department of Commerce for official comment. We expect to issue the report by September 2016.

The work upon which this statement was based was conducted in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

Background

Since the 1960s, the United States has operated polar-orbiting satellite systems that obtain environmental data to support weather observations and forecasts. These data are processed to provide graphical weather images and specialized weather products. Data from polar satellites are also the predominant input to numerical weather prediction models, which are a primary tool for forecasting weather days in advance—including forecasting the path and intensity of hurricanes. These weather products and models are used to predict the potential impact of severe weather so that communities and emergency managers can help prevent and mitigate its effects.

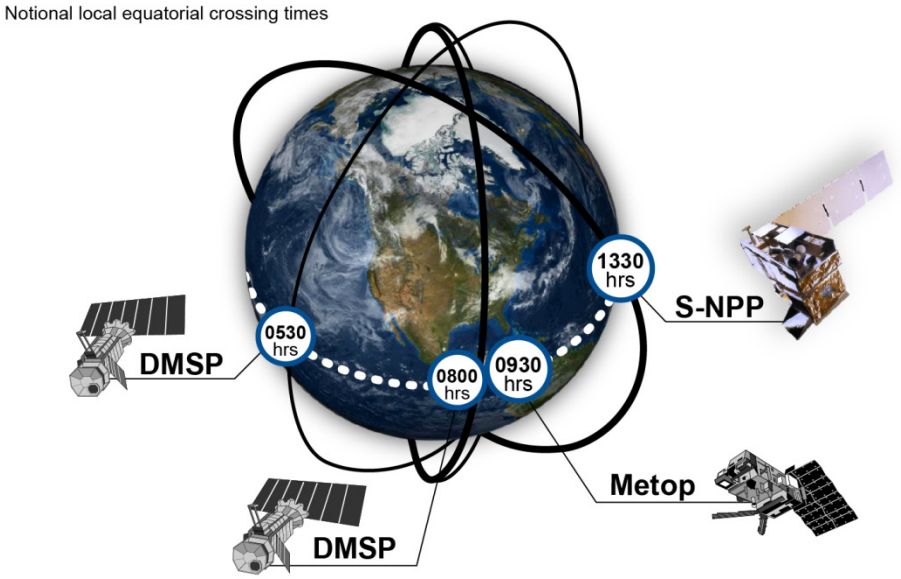
Polar-orbiting satellites circle the earth in a nearly north-south orbit, providing global observation of conditions that affect the weather and climate. Each satellite makes about 14 orbits a day. As the earth rotates

[2]GAO, *Polar Weather Satellites: NOAA Is Working to Ensure Continuity but Needs to Quickly Address Information Security Weaknesses and Future Program Uncertainties,* GAO-16-359 (Washington, D.C.: May 17, 2016).

beneath it, each polar-orbiting satellite views the entire earth's surface twice a day.

Currently, the polar-orbiting satellites that are considered primary satellites for providing input to weather forecasting models are a NOAA/NASA satellite (called Suomi National Polar-orbiting Partnership, or S-NPP), two Department of Defense (DOD) satellites, and a series of European satellites. These satellites cross the equator in early morning, mid-morning, and early afternoon orbits, with S-NPP in the early afternoon orbit. NOAA, the Air Force, and a European weather satellite organization also maintain older satellites that provide limited backup to these operational satellites. Figure 1 illustrates the current operational polar satellite constellation.

Figure 1: Configuration of Operational Polar Satellites



Sources: GAO, based on NPOESS Integrated Program Office, National Oceanic and Atmospheric Administration, and Department of Defense data; National Aeronautics and Space Administration/Goddard Space Flight Center Scientific Visualization Studio (earth); S-NPP image provided courtesy of University of Wisconsin-Madison Space Science and Engineering Center. | GAO-16-773T

Note: DMSP – Defense Meteorological Satellite Program; Metop – Meteorological Operational; S-NPP – Suomi National Polar-orbiting Partnership.

According to NOAA, 80 percent of the data assimilated into its National Weather Service numerical weather prediction models that are used to produce weather forecasts 3 days and beyond are provided by polar-orbiting satellites. Specifically, a single afternoon polar satellite provides NOAA 45 percent of the global coverage it needs for its numerical

weather models. NOAA obtains the rest of the polar satellite data it needs from other satellite programs, including DOD's early morning satellites and the European mid-morning satellite.

Overview of JPSS Program

NOAA is currently executing a major satellite acquisition program to replace existing polar satellite systems that are nearing the end of their expected life spans. NOAA established the JPSS program in 2010 after a prior tri-agency program was disbanded due to technical and management challenges, cost growth, and schedule delays.[3] The JPSS program guided the development and launch of the S-NPP satellite in 2011[4] and is responsible for two other planned JPSS satellites, known as JPSS-1 and JPSS-2. The current anticipated launch dates for these two satellites are March 2017 and December 2021, respectively. More recently, NOAA has also begun planning the Polar Follow-On (PFO) program, which is to include the development and launch of a third and fourth satellite in the series in July 2026 and July 2031, respectively. These are planned to be nearly identical to the JPSS-2 satellite.

NOAA has organized the JPSS program into flight and ground projects that have separate areas of responsibility. The flight project includes a set of five instruments, the spacecraft, and launch services. The ground project consists of ground-based systems that handle satellite communications and data processing. The ground system's versions are numbered; the version that is currently in use is called Block 1.2, and the new version that is under development is called Block 2.0. Among other things, Block 2.0 is to enable the JPSS ground system to support both the S-NPP and all planned JPSS satellites.

Since 2012, we have issued reports on the JPSS program that highlighted technical issues, component cost growth, management

[3]The National Polar-orbiting Operational Environmental Satellite System was a tri-agency program made up of NOAA, the Department of Defense, and NASA. It was disbanded in 2010.

[4]S-NPP was originally planned as a demonstration satellite, but due to schedule delays that had the potential to lead to satellite data gaps, NOAA made the decision to use it as an operational satellite. This means that the satellite's data are used for climate and weather products.

challenges, and key risks.[5] In these reports, we made 15 recommendations to NOAA to improve the management of the JPSS program. These recommendations included addressing key risks, establishing a comprehensive contingency plan consistent with best practices, and addressing weaknesses in information security practices.

As we reported in May 2016, the agency had implemented 2 recommendations and was working to address the remainder. In particular, NOAA established contingency plans to mitigate the possibility of a polar satellite data gap and began tracking completion dates for its gap mitigation activities. NOAA has also taken steps such as performing a new schedule risk analysis, and adding information on the impact of space debris to its annual assessment of satellite availability. We have ongoing work reviewing the agency's progress in implementing these open recommendations.

NOAA Continues to Develop JPSS Satellites, but Faces Remaining Challenges and Uncertainties Regarding Future Decisions

Over the past year, the JPSS program has made progress in developing the JPSS-1 satellite, but continues to face challenges as it approaches the early 2017 launch date. The program completed all instruments on the JPSS-1 satellite and integrated them on the spacecraft by early 2016. As of December 2015, the JPSS program reported that it remained on track to meet its committed launch date of March 2017.

However, as highlighted in our May 2016 report, the JPSS program continues to face challenges as it approaches the early 2017 launch date.[6] Specifically, the JPSS program had experienced delays ranging from 3 to 10 months on key components since mid-2014, as well as technical challenges on both the flight and ground systems. For example, the program recently experienced multiple issues in completing a component on the spacecraft, called a gimbal,[7] which moved the

[5]See GAO-16-359; GAO, *Polar Weather Satellites: NOAA Needs To Prepare for Near-term Data Gaps*, GAO-15-47 (Washington, D.C.: Dec. 16, 2014); *Polar Weather Satellites: NOAA Identified Ways to Mitigate Data Gaps, but Contingency Plans and Schedules Require Further Attention*, GAO-13-676 (Washington, D.C.: Sept. 11, 2013); and *Polar-Orbiting Environmental Satellites: Changing Requirements, Technical Issues, and Looming Data Gaps Require Focused Attention,* GAO-12-604 (Washington, D.C.: June 15, 2012).

[6]See GAO-16-359.

[7]A gimbal provides articulation for selected antennas responsible for transmitting stored data to communication satellites and ground systems.

component's planned completion date forward by almost a year before it was completed in March 2016. These issues in turn delayed the beginning of the JPSS-1 satellite's environmental testing. The gimbal issue also was a factor in the program choosing to move back its launch readiness date—the date that the JPSS-1 satellite is planned to be ready for launch—from December 2016 to January 2017.

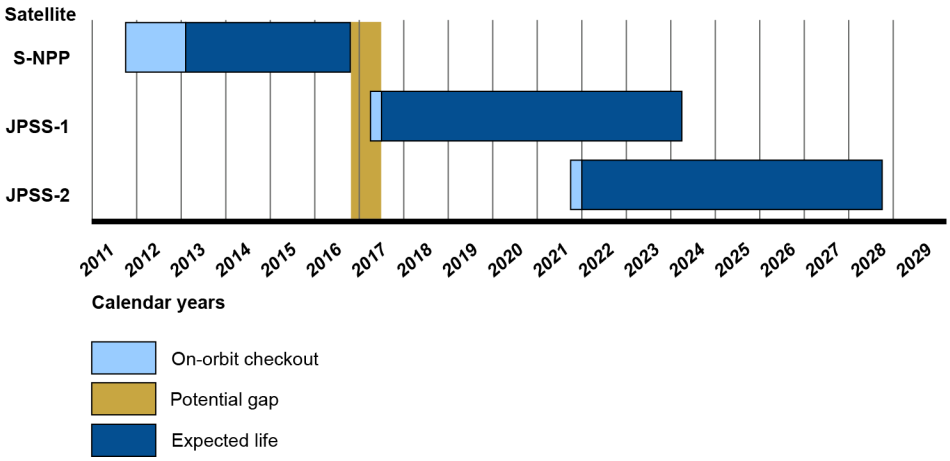
Regarding the JPSS ground system, the program experienced an unexpectedly high number of program trouble reports in completing the upgrade to Block 2.0, which is needed for security and requirements improvements in tandem with the JPSS-1 satellite's launch. A key milestone related to this upgrade was recently delayed from January to August 2016.

While NOAA satellite timelines show continuous coverage in the afternoon orbit, the JPSS program still faces the potential for a near-term gap in satellite coverage. As we reported in May 2016, NOAA had increased the estimated useful life for S-NPP by up to 4 years. Under this new scenario, a near-term gap in satellite data would not be expected because S-NPP would last longer than the expected start of operations for JPSS-1.

However, subsequent NOAA documentation showed this 4-year period as "fuel limited life." NOAA officials explained that this extended period is based on expected fuel availability, and does not take into account the likelihood that the instruments and spacecraft will fail before the satellite runs out of fuel. In other words, the extended useful life depicts the satellite's maximum possible life, not its expected life.

As a result, the JPSS program continues to face a potential gap of 8 months between the end of S-NPP's expected life in October 2016, and when the JPSS-1 satellite is launched and completes post-launch testing in June 2017. Figure 2 shows the potential gap period.

Figure 2: Timeline for a Potential Gap in Polar Satellite Data in the Afternoon Orbit



Source: GAO analysis based on National Oceanic and Atmospheric Administration and National Aeronautics and Space Administration data. | GAO-16-773T

Note: The afternoon orbit is one of three primary polar orbits. A single afternoon polar satellite provides NOAA 45 percent of the global coverage it needs for its numerical weather models.

The June 2017 completion date also assumes a 3 month period for the JPSS-1 satellite's on-orbit checkout. However, based on on-orbit checkout periods from past polar satellites, it is likely that checkout could take longer than this, potentially lengthening the gap. As a precedent, it took the JPSS program about 2 years to fully validate the highest-priority data products from the S-NPP satellite. If S-NPP unexpectedly fails sooner, or the JPSS-1 launch date is delayed, a longer gap could result.

Uncertainties Remain on Key Future JPSS Development Dates

In addition to its work in completing the JPSS-1 satellite, NOAA has begun planning for new satellites to ensure the future continuity of polar satellite data. In a new program, called the Polar Follow-On (PFO), NOAA plans to build two new satellites, JPSS-3 and JPSS-4, that are copies of the JPSS-2 satellite. Like JPSS-2, these satellites are to include all three key performance parameter instruments, as well as a fourth environmental sensor. NOAA plans to complete development of JPSS-3 and JPSS-4 several years ahead of their planned launch date. In the nearer term, NOAA plans to build a smaller satellite that can provide a replacement for some data produced by one of the most essential JPSS instruments.

NOAA's decisions on what PFO will include are based on what the agency calls a robust constellation, creating a situation where it would take two failures to create a gap on data from key instruments, and where the agency would be able to restore full coverage in a year in the event of a failure.

We reported in May 2016 that NOAA has taken several steps in planning the PFO program, including establishing goal launch dates and high-level budget estimates. However, it had not completed formulation documents such as high-level requirements, a project plan, or budget information for key components.

In addition, uncertainties remain about whether early development of JPSS-3 and JPSS-4 is necessary to achieve robustness. For instance, in its initial calendar for PFO, NOAA considered lifetimes of 10 years or more for the JPSS-1 and JPSS-2 satellites, while NOAA charts used for budget justification continue to show only 7 year lifetimes. If satellites are likely to last longer than expected, there could be unnecessary redundancy in coverage. Until NOAA ensures that its plans for future polar satellite development are based on the full range of estimated lives of potential satellites, the agency may not be making the most efficient use of the nation's sizable investment in the polar satellite program.

As a result of this uncertainty, we recommended that NOAA evaluate the costs and benefits of different launch scenarios for the JPSS PFO program, based on updated satellite life expectancies, to ensure satellite continuity while minimizing program costs. NOAA concurred and noted that it had evaluated the costs and benefits of different launch scenarios using the latest estimates of satellite lives as part of its budget submission. However, the agency did not provide sufficient supporting evidence or artifacts showing that it had evaluated costs and benefits of launch scenarios in this way.

NOAA's Timelines for Current and Future NOAA Polar Satellites Are Not Consistently Accurate and Useful

NOAA's National Environmental Satellite Data and Information Service (NESDIS) regularly publishes "flyout charts" for its satellites which depict timelines for the launch, on-orbit storage, and operational life of its satellites. Among other things, NOAA uses these charts to support budget requests, alert users when new satellites will be operational, and keep the public informed on plans to maintain satellite continuity.

In a draft report currently at the Department of Commerce for comment, we reported that NOAA has updated its polar flyout charts three times in

the last 2-and-a-half years. Key changes that can result in an update include adding newly planned satellites; removing a satellite that has reached the end of its life; and adjusting planned dates for when satellites are to launch, begin operations, or reach the end of their useful lives. Among the data NOAA uses in updating its charts are health status information of operational satellites, planned schedules for new satellites, and analysis from operational satellite experts.

However, while NOAA regularly updates its charts and most of the data on them were aligned with other program documentation, the agency has not consistently ensured that its charts were accurate, supported by stringent analysis, and fully documented. Specifically:

- The charts were at times inconsistent with other program data. For example, in one out of 10 available instances for comparison, flyout chart data did not match underlying program data. JPSS program data as of April 2015 listed the JPSS-2 satellite launch as November 2021, but the flyout chart from that month showed it 4 months earlier, in July 2021.

  The flyout charts also inconsistently reflected data from annual satellite availability assessments performed by the JPSS program. In addition, weaknesses remained in the latest annual availability assessment from 2015. For example, NOAA assumed that JPSS-1 data from key instruments will be available to users 3 months after launch. However, based on on-orbit checkout periods from past polar satellites, it is likely that checkout could take much longer than this, potentially lengthening the gap.

- NOAA did not consistently document the justification for updates to its polar satellite flyout charts. For example, the NOAA department responsible for providing summary packages for each flyout chart update provided justification for the key changes in only one of three documentation packages. Furthermore, standard summary documents, such as a routing list and information on the disposition of comments, were included for only one of the three documentation packages for polar flyout charts.

- NOAA also does not consistently depict how long a satellite might last once it is beyond its design life. For instance, NESDIS, the NOAA entity responsible for satellite operations, recently added a 4-year extension to the useful life of the S-NPP satellite. This extension was meant to depict maximum potential life, assuming all instruments and the spacecraft continue functioning. However, the agency did not

clearly define this term on its charts, thereby allowing readers to assume the agency expects the satellites to last through the end of the fuel-limited life period.

Also, as stated above, in its justification for funding for the PFO program, NOAA considered lifetimes for JPSS-1 and JPSS-2 to be longer by several years when compared to the lifetimes listed on its flyout charts. Program officials indicated that the estimates they develop prior to a satellite's launch are more conservative due to greater uncertainty at that stage. However, inconsistencies such as these have the effect of implying that some satellites will reach their end-of-life sooner or later than the agency anticipates.

Part of the reason for these process shortfalls is that NOAA has not finalized a policy with standard steps to follow when making chart updates. Consequently, the information that NOAA provides Congress on the flyout charts is not as accurate as it needs to be, which could result in less-than-optimal decisions. Furthermore, lack of communication of the potential ambiguities inherent in changes to satellite lifetimes could have major effects on future decision-making.

To address these weaknesses, our draft report includes a series of recommendations to NOAA, including requiring satellite programs to perform regular assessments of satellite availability, implementing a consistent approach to depicting satellites beyond their design lives, and revising and finalizing the policy for updating flyout charts.

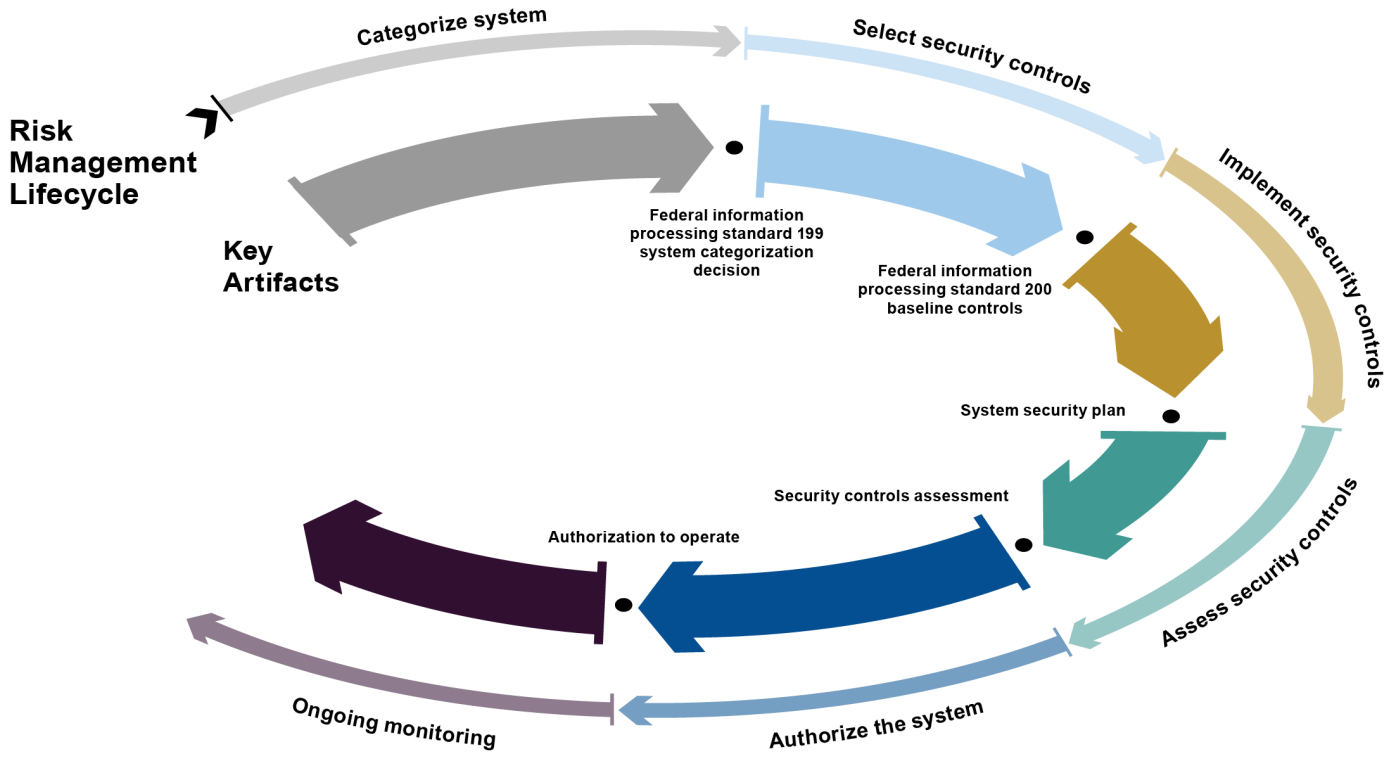
The JPSS Program Needs to Address Critical Information Security Weaknesses

Safeguarding federal computer systems and systems supporting national infrastructure is essential to protecting public health and safety. Federal law and guidance specify requirements for protecting federal information and information systems. In particular, the Federal Information Security Modernization Act of 2014 (FISMA) requires executive branch agencies to develop, document, and implement an agency-wide information security program.

FISMA also requires the National Institute of Standards and Technology (NIST)[8] to develop standards and guidelines for agencies to use in categorizing their information systems and minimum requirements for each category. Accordingly, NIST developed a risk management framework of standards and guidelines to follow in developing information security programs. Figure 3 shows an overview of the steps in this framework, including components of the risk management lifecycle as well as key activities and artifacts.

[8]The Federal Information Security Modernization Act of 2014, Pub. L. No. 113-283, 128 Stat. 3073 (Dec. 18, 2014), largely supersedes the very similar Federal Information Security Management Act of 2002, Pub. L. No. 107-347, 116 Stat. 2899, 2946 (Dec. 17, 2002). The 2002 act's requirements that the National Institute of Standards and Technology establish standards and guidance for implementation of the act were not superseded and continue to apply.

Figure 3: Overview of the National Institute of Standards and Technology's Risk Management Framework for an Information Security Program



Sources: GAO and National Institute of Standards and Technology. | GAO-16-773T

As we reported in May 2016, NOAA had established information security policies in key areas detailed by FISMA and recommended by NIST guidance and the JPSS program had made progress in implementing these policies.[9] However, we found that the program had weaknesses in several areas related to its ground system which, if not addressed, could put the JPSS ground system at high risk of compromise.

- **Key controls not fully implemented.** The JPSS program, using NIST guidance on system categorization, identified its ground system as a high-impact system, meaning that a loss of confidentiality,

[9]GAO-16-359.

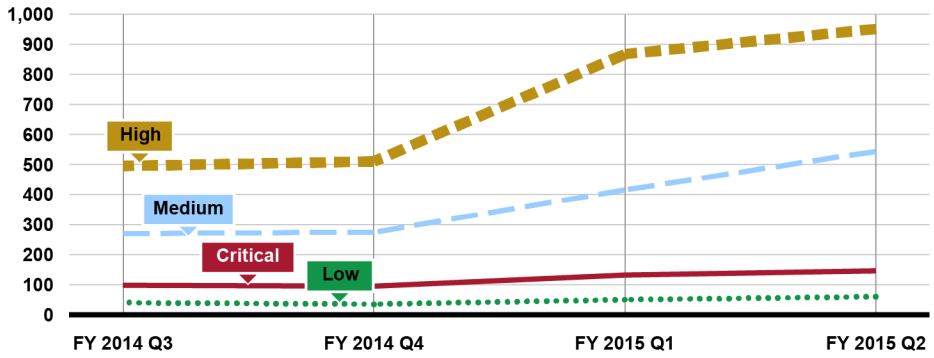
integrity, or availability could be expected to have a catastrophic effect on operations, and identified needed security controls based on this classification. However, the program had fully implemented only 53 percent of required security controls, and had fully implemented controls in only one area.

- **Limitations in controls assessment**. The program developed an assessment plan to identify weaknesses in the controls established by the program, and implemented the assessment. However, the assessment had significant limitations, including inconsistencies in maintaining a valid inventory, uncertainty about the physical locations for program components, and a discrepancy between the inventory used for testing and the actual live inventory of the program's systems.

- **Delay in fixing critical weaknesses**. In accordance with NOAA policy, the program established plans of action and milestones to address control weaknesses in both the current and future version of its ground system, and had made progress in addressing many of its security weaknesses through this process. However, many vulnerabilities remain unaddressed because the program did not comply with Department of Commerce policy to remediate critical and high-risk vulnerabilities within 30 days.

  As of its 2015 assessment of program controls, the JPSS program had 146 critical and 951 high-risk vulnerabilities on the current iteration of the ground system, and 102 critical and 295 high-risk vulnerabilities on the next iteration of the ground system. Vulnerabilities remaining open include instances of outdated software, an obsolete web server, as well as more than 200 instances of use of outdated definitions used to scan and identify viruses. Figure 4 graphically shows the number of open vulnerabilities on the current JPSS ground system over time.

Figure 4: Open Vulnerabilities Identified on the Current Joint Polar Satellite System's Ground System



Source: GAO, based on National Oceanic and Atmospheric Administration data. | GAO-16-773T

Note: NOAA identifies vulnerabilities as critical, high, medium, and low risk. Critical and high-risk vulnerabilities pose an increased risk of compromise.

Without addressing these vulnerabilities in a timely manner, the program remains at increased risk of potential exploits.

- **Security incidents reported but not consistently tracked**. In accordance with NOAA policy, the JPSS program established a continuous monitoring plan to track security incidents and intrusions and to ensure that information security controls are working. Specifically, NOAA officials reported 10 medium and high-severity incidents related to the JPSS ground system, including incidents involving unauthorized access to web servers and computers, between August 2014 and August 2015. Of these, NOAA closed 6 incidents involving hostile probes, improper usage, unauthorized access, password sharing, and other IT-related security concerns.

  However, the agency did not consistently track all incidents. Specifically, there were differences between what is being tracked by the JPSS program, and what is closed by NOAA's incident response team. For example, 2 of the 4 incidents that were recommended for closure by the JPSS program office are currently still open according to the incident report. Until NOAA and the JPSS program have a consistent understanding of the status of incidents, there is an increased risk that key vulnerabilities will not be identified or properly addressed.

To address these deficiencies, we recommended in our May 2016 report that the Secretary of Commerce direct the Administrator of NOAA to

establish a plan to address the limitations in the program's efforts to test security controls, including ensuring that (1) any changes in the system's inventory do not materially affect test results; (2) critical and high-risk vulnerabilities are addressed within 30 days, as required by agency policy; and (3) the agency and program are tracking and closing a consistent set of incident response activities.

NOAA concurred with our recommendations. Regarding critical and high-risk vulnerabilities, NOAA noted that the JPSS program would continue to follow agency policy allowing its authorizing official to accept risks when remediation cannot be performed as anticipated. However, the program did not have documentation from the authorizing official accepting the risk of a delayed remediation schedule for critical and high-risk vulnerabilities.

In summary, NOAA is making progress in developing and testing the JPSS-1 satellite as it moves toward a March 2017 launch date, but continues to experience issues in remaining ground system development, and faces a potential near-term data gap in the period before this satellite becomes operational. In addition, NOAA is planning to launch a future set of satellites to ensure continuity of future satellite data, but it is uncertain which launch timing will best meet the agency's criteria for a robust constellation. Without ensuring that its plans for future satellite development are based on the full range of estimated lives of potential satellites, the agency may not be making the most efficient use of the nation's sizable investment in the polar satellite program.

Further, findings from a draft report show that NOAA's efforts to depict and update key polar satellite information, such as timelines and operational life, need to be improved. Its flyout charts, used to inform users of potential gaps and support budget requests, did not always accurately reflect current program data or consistently present key information, such as a satellite's lifetime once beyond its original design life. This is in part because NOAA has not finalized a policy that includes standard steps for updating its charts. Until NOAA addresses these shortfalls, it runs an increased risk that its flyout charts will mislead Congress and may lead to less-than-optimal decisions.

As a part of JPSS ground system development, NOAA has established policies in key information security areas called for by guidance. However, the program has not fully implemented the policy in several areas. For example, the program fully implemented just over half of its required security controls, a recent security assessment itself had

significant limitations, and the program has not remediated critical and high-risk vulnerabilities in a timely manner. Until NOAA addresses these weaknesses, the JPSS ground system remains at high risk of compromise.

Chairman Bridenstine, Ranking Member Bonamici, and Members of the Subcommittee, this completes my prepared statement. I would be pleased to respond to any questions that you may have at this time.

GAO Contacts and Staff Acknowledgments

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