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POLAR-ORBITING SATELLITES

With Costs Increasing and Data Continuity at Risk, Improvements Needed in Tri-agency Decision Making

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Information Technology Management Issues



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Highlights of [GAO-09-772T](#), a testimony before the Subcommittee on Investigations and Oversight, Committee on Science and Technology, House of Representatives

Why GAO Did This Study

The National Polar-orbiting Operational Environmental Satellite System (NPOESS)—a tri-agency acquisition managed by the Department of Commerce’s National Oceanic and Atmospheric Administration (NOAA), the Department of Defense (DOD), and the National Aeronautics and Space Administration (NASA)—is considered critical to the United States’ ability to maintain the continuity of data required for weather forecasting (including severe weather events such as hurricanes) and global climate monitoring. Since its inception, NPOESS has experienced escalating costs, schedule delays, and technical difficulties. As the often-delayed launch of its demonstration satellite (called the NPOESS Preparatory Project—NPP) draws closer, these problems continue.

GAO was asked to summarize its report being released today that (1) identifies the status and risks of key program components, (2) assesses the NPOESS Executive Committee’s ability to fulfill its responsibilities, and (3) evaluates efforts to identify an alternative system integrator for later NPOESS satellites.

What GAO Recommends

In its report, GAO recommended steps to improve the effectiveness of the Executive Committee. NASA and Commerce officials concurred with the recommendations; DOD concurred with one and partially concurred with the other recommendations.

[View GAO-09-772T or key components.](#) For more information, contact David A. Powner at (202) 512-9286 or pownerd@gao.gov.

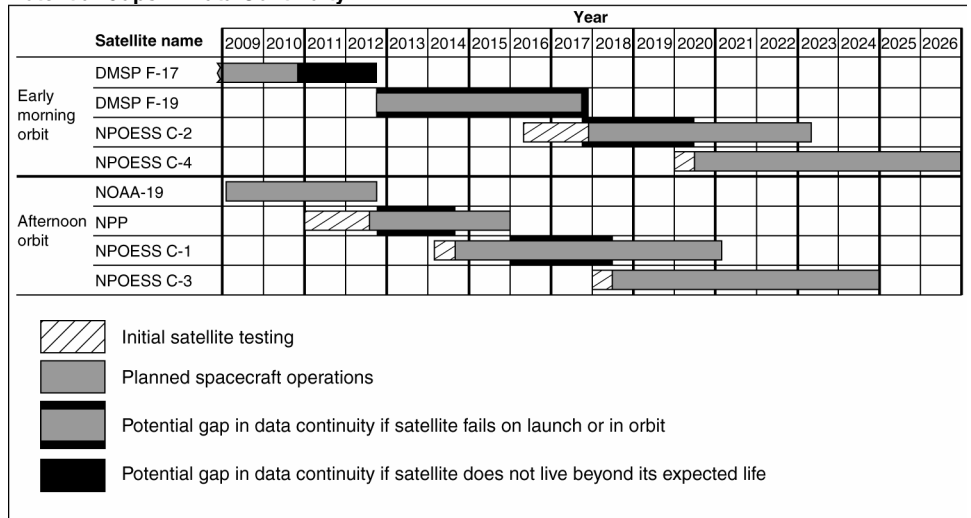
POLAR-ORBITING SATELLITES

With Costs Increasing and Data Continuity at Risk, Improvements Needed in Tri-agency Decision Making

What GAO Found

The NPOESS program’s approved cost and schedule baseline is not achievable and problems with two critical sensors continue to drive the program’s cost and schedule. Costs are expected to grow by about \$1 billion from the current \$13.95 billion cost estimate, and the schedules for NPP and the first two NPOESS satellites are expected to be delayed by 7, 14, and 5 months, respectively. These delays endanger the continuity of weather and climate satellite data because there will not be a satellite available as a backup should a satellite fail on launch or in orbit—loss of a Defense Meteorological Satellite Program (DMSP) satellite, an NPOESS satellite, or NPP could result in a 3 to 5 year gap in data continuity (see figure below). Program officials reported that they are assessing alternatives for mitigating risks, and that they plan to propose a new cost and schedule baseline by the end of June 2009. However, the Executive Committee does not have an estimate for when it will make critical decisions on cost, schedule, and risk mitigation.

Potential Gaps in Data Continuity



Source: GAO analysis of DOD, NOAA, and NPOESS Integrated Program Office data.

While the NPOESS Executive Committee has made improvements over the last several years in response to prior recommendations, it has not effectively fulfilled its responsibilities and does not have the membership and leadership it needs to effectively or efficiently oversee and direct the NPOESS program. Until its shortfalls are addressed, the Committee will be unable to effectively oversee the NPOESS program—and important issues involving cost growth, schedule delays, and satellite continuity will likely remain unresolved.

The NPOESS program has conducted two successive studies of alternatives to using the existing system integrator for the last two NPOESS satellites, but neither identified a viable alternative to the current contractor. Program officials plan to conduct a final study prior to the June 2010 decision on whether to proceed with the existing prime contractor.

Mr. Chairman and Members of the Subcommittee:

Thank you for the opportunity to participate in today's hearing on the National Polar-orbiting Operational Environmental Satellite System (NPOESS). NPOESS is expected to be a state-of-the-art satellite system that will replace two existing satellite systems. It is considered critical to the United States' ability to maintain the continuity of data required for weather forecasting (including severe weather events such as hurricanes) and global climate monitoring. Three agencies share responsibility for NPOESS: the Department of Commerce's National Oceanic and Atmospheric Administration (NOAA), the Department of Defense (DOD)/United States Air Force, and the National Aeronautics and Space Administration (NASA). As requested, this statement summarizes our report being released today that (1) identifies the status and risks of key program components, (2) assesses the NPOESS Executive Committee's ability to fulfill its responsibilities, and (3) evaluates efforts to identify an alternative system integrator for later NPOESS satellites.¹

In preparing this testimony, we relied on our work supporting the accompanying report. That report contains a detailed overview of our scope and methodology. All of our work for this report was performed 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

Polar-orbiting satellites provide data and imagery that are used by weather forecasters, climatologists, and the military to map and monitor changes in weather, climate, the oceans, and the environment. Since the 1960s, the United States has operated two separate operational polar-orbiting meteorological satellite systems: the Polar-orbiting Operational Environmental Satellite (POES) series, which is managed by NOAA, and the Defense Meteorological Satellite Program (DMSP), which is managed by the Air Force. Currently, there is one operational POES satellite and

¹GAO, *Polar-orbiting Environmental Satellites: With Costs Increasing and Data Continuity at Risk, Improvements Needed in Tri-agency Decision Making*, [GAO-09-564](#) (Washington, D.C.: June 17, 2009).

two operational DMSP satellites that are positioned so that they can observe the earth in early morning, midmorning, and early afternoon polar orbits. In addition, the government is also relying on a European satellite, called Meteorological Operational, or MetOp, in the midmorning orbit.

With the expectation that combining the POES and DMSP programs would reduce duplication and result in sizable cost savings, a May 1994 Presidential Decision Directive required NOAA and DOD to converge the two satellite programs into a single satellite program capable of satisfying both civilian and military requirements.² The converged program, NPOESS, is considered critical to the United States' ability to maintain the continuity of data required for weather forecasting and global climate monitoring. To manage this program, DOD, NOAA, and NASA formed the tri-agency Integrated Program Office, located within NOAA. Within the program office, each agency has the lead on certain activities: NOAA has overall program management responsibility for the converged system and for satellite operations; the Air Force has the lead on the acquisition; and NASA has primary responsibility for facilitating the development and incorporation of new technologies into the converged system. NOAA and DOD share the cost of funding NPOESS, while NASA funds specific technology projects and studies. In addition, an Executive Committee—made up of the administrators of NOAA and NASA and the Under Secretary of Defense for Acquisition, Technology, and Logistics—is responsible for providing policy guidance, ensuring agency support and funding, and exercising oversight authority.³ The Executive Committee manages the program through a Program Executive Officer who oversees the NPOESS program office.

Since the program's inception, NPOESS costs have grown to \$13.95 billion, and launch schedules have been delayed by up to five years.⁴ In addition, as a result of a 2006 restructuring of the program, the agencies reduced the program's functionality by removing 2 of 6 originally planned satellites and one of the orbits. The restructuring also decreased the number of

²Presidential Decision Directive NSTC-2, May 5, 1994.

³The Under Secretary of Defense for Acquisition, Technology, and Logistics delegated the responsibility for attending the meetings—but not the authority to make acquisition decisions—to the Under Secretary of the Air Force.

⁴Compared to original program plans, the demonstration satellite has been delayed by approximately four and a half years, while the first two NPOESS satellites have each been delayed by approximately five years.

instruments from 13 (10 sensors and 3 subsystems) to 9 (7 sensors and 2 subsystems), with 4 of the sensors providing fewer capabilities. The restructuring also led agency executives to mitigate potential data gaps by deciding to use a planned demonstration satellite, called the NPOESS Preparatory Project (NPP) satellite, as an operational satellite providing climate and weather data. However, even after this restructuring, the program is still encountering technical issues, schedule delays, and the likelihood of further cost increases.

Progress Made, but Continued Instrument Problems Are Driving Costs Upward, Forcing Launch Delays, and Endangering Satellite Continuity

Over the past year, selected components of the NPOESS program have made progress. Specifically, three of the five instruments slated for NPP have been delivered and integrated on the spacecraft; the ground-based satellite data processing system has been installed and tested at both of the locations that are to receive NPP data; and the satellites' command, control, and communications system has passed acceptance testing. However, problems with two critical sensors continue to drive the program's cost and schedule. Specifically, challenges with a key sensor's (the Visible/infrared imager radiometer suite (VIIRS)) development, design, and workmanship have led to additional cost overruns and delayed the instrument's delivery to NPP. In addition, problems discovered during environmental testing on another key sensor (called the Cross-track infrared sounder (CrIS)) led the contractor to further delay its delivery to NPP and added further unanticipated costs to the program. To address these issues, the program office halted or delayed activities on other components (including the development of a sensor planned for the first NPOESS satellite, called C1) and redirected those funds to fixing VIIRS and CrIS. As a result, those other activities now face cost increases and schedule delays.

Program officials acknowledge that NPOESS will cost more than the \$13.95 billion previously estimated, but they have not yet adopted a new cost estimate. Program officials estimated that program costs will grow by about \$370 million due to recent technical issues experienced on the sensors and the costs associated with halting and then restarting work on other components of the program. In addition, the costs associated with adding new information security requirements to the program could reach \$200 million.⁵ This estimate also does not include approximately \$410

⁵These estimates are subject to further refinement because the Executive Committee has not agreed on a cost estimating methodology and the agencies have not yet agreed to new information security requirements.

million for operations and support costs for the last two years of the program's life cycle (2025 and 2026). Thus, we anticipate that the overall cost of the program could grow by about \$1 billion from the current \$13.95 billion estimate—especially given the fact that difficult integration and testing of the sensors on the NPP and C1 spacecrafts has not yet occurred.⁶ Program officials reported that they plan to revise the program's cost estimate over the next few weeks and to submit it for executive-level approval by the end of June 2009.

As for the program's schedule, program officials estimate that the delivery of VIIRS to the NPP contractor will be delayed, resulting in a further delay in the launch of the NPP satellite to January 2011, a year later than the date estimated during the program restructuring—and seven months later than the June 2010 date that was established last year. In addition, program officials estimated that the first and second NPOESS satellites would be delayed by 14 and 5 months, respectively, because selected development activities were halted or slowed to address VIIRS and CrIS problems. The program's current plans are to launch C1 in March 2014 and the second NPOESS satellite, called C2, in May 2016. Program officials notified the Executive Committee and DOD's acquisition authority of the schedule delays, and under DOD acquisition rules, are required to submit a new schedule baseline by June 2009.

These launch delays have endangered our nation's ability to ensure the continuity of polar-orbiting satellite data. The final POES satellite, called NOAA-19, is in an afternoon orbit and is expected to have a 5-year lifespan. Both NPP and C1 are planned to support the afternoon orbit. Should the NOAA-19 satellite fail before NPP is launched, calibrated, and operational, there would be a gap in satellite data in that orbit. Further, the delays in C1 mean that NPP will not be the research and risk reduction satellite it was originally intended to be. Instead, it will have to function as an operational satellite until C1 is in orbit and operational—and if C1 fails on launch or in early operations, NPP will be needed to function until C3 is available, currently planned for 2018. The delay in the C2 satellite launch affects the early morning orbit. There are three more DMSP satellites to be launched in the early and midmorning orbits, and DOD is revisiting the launch schedules for these satellites to try to extend them as long as possible. However, an independent review team, established to assess key program

⁶This cost estimate includes launch vehicle costs of approximately \$329 million, which are funded outside the program's baseline.

risks, recently reported that the constellation of satellites is extremely fragile and that a single launch failure of a DMSP, NPOESS, or the NPP satellite could result in a gap in satellite coverage from 3 to 5 years.

Although the program's approved cost and schedule baseline is not achievable and the polar satellite constellation is at risk, the Executive Committee has not yet made a decision on how to proceed with the program. Program officials plan to propose new cost and schedule baselines in June 2009 and have reported that they are addressing immediate funding constraints by deferring selected activities to later fiscal years in order to pay for VIIRS and CrIS problems; delaying the launches of NPP, C1, and C2; and assessing alternatives for mitigating the risk that VIIRS will continue to experience problems. Without an executive-level decision on how to proceed, the program is proceeding on a course that is deferring cost growth, delaying launches, and risking its underlying mission of providing operational weather continuity to the civil and military communities.

Executive Committee Has Not Effectively Fulfilled Its Responsibilities

While the NPOESS Executive Committee has made improvements over the last several years in response to prior recommendations, it has not effectively fulfilled its responsibilities and does not have the membership and leadership it needs to effectively or efficiently oversee and direct the NPOESS program. Specifically, the DOD Executive Committee member with acquisition authority does not attend Committee meetings—and sometimes contradicts the Committee's decisions, the Committee does not aggressively manage risks, and many of the Committee's decisions do not achieve desired outcomes. Independent reviewers, as well as program officials, explained that the tri-agency structure of the program makes it very difficult to effectively manage the program. Until these shortfalls are addressed, the Committee is unable to effectively oversee the NPOESS program—and important issues involving cost growth, schedule delays, and satellite continuity will likely remain unresolved.

Executive Committee Has Responded to Past Recommendations

We and others, including the Department of Commerce's Inspector General in a 2006 report, have reported that the Committee was not accomplishing its job effectively. However, since then, the Committee has met regularly on a quarterly basis and held interim teleconferences as needed. The Committee has also sought and reacted to advice from external advisors by, among other actions, authorizing a government program manager to reside onsite at the VIIRS contractor's facility to improve oversight of the sensor's development on a day-to-day basis. More

recently, the Executive Committee sponsored a broad-based independent review of the NPOESS program and is beginning to respond to its recommendations.

Key Acquisition Executive Does Not Attend Executive Committee Meetings

As established by the 1995 and 2008 memorandums of agreement signed by all three agencies, the members of the NPOESS Executive Committee are (1) the Under Secretary of Commerce for Oceans and Atmosphere; (2) the Under Secretary of Defense for Acquisition, Technology, and Logistics; and (3) the NASA Administrator.⁷ Because DOD has the lead responsibility for the NPOESS acquisition, the Under Secretary of Defense for Acquisition, Technology, and Logistics was also designated as the milestone decision authority—the individual with the authority to approve a major acquisition program’s progression in the acquisition process, as well as any changes to the cost, schedule, and functionality of the acquisition. The intent of the tri-agency memorandums was that acquisition decisions would be agreed to by the Executive Committee before a final acquisition decision is made by the milestone decision authority.⁸

However, DOD’s acquisition authority has never attended an Executive Committee meeting. This individual delegated the responsibility for attending the meetings—but not the authority to make acquisition decisions—to the Under Secretary of the Air Force. Therefore, none of the individuals who attend the Executive Committee meetings for the three agencies have the authority to approve the acquisition program baseline or major changes to the baseline. As a result, agreements between Committee members have been overturned by the acquisition authority, leading to significant delays.

⁷The 1995 agreement specified that the NASA member would be the Deputy Administrator. Responsibility was subsequently taken over by the Administrator of NASA.

⁸The 1995 and 2008 memorandums of agreement differ slightly in this regard. The first agreement stated that DOD’s milestone decision authority will make acquisition decisions with concurrence of the other Executive Committee members, while the second agreement states that the DOD authority must consider Committee decisions. The second agreement takes precedence in the case of a conflict.

Committee Does Not Aggressively Manage Risks

To provide the oversight recommended by best practices,⁹ including reviewing data and calling for corrective actions at the first sign of cost, schedule, and performance problems and ensuring that actions are executed and tracked to completion, the Executive Committee holds quarterly meetings during which the program's progress is reviewed using metrics that provide an early warning of cost, schedule, and technical risks. However, the Committee does not routinely document action items or track those items to closure. Some action items were not discussed in later meetings, and in cases where an item was discussed, it was not always clear what action was taken, whether it was effective, and whether the item was closed.

According to the Program Executive Officer, the closing of an action item is not always explicitly tracked because it typically involves gathering information that is presented during later Committee meetings. Nonetheless, by not rigorously documenting action items—including identifying the party responsible for the action, the desired outcome, and the time frame for completion—and then tracking the action items to closure, the Executive Committee is not able to ensure that its actions have achieved their intended results and to determine whether additional changes or modifications are still needed. This impedes the Committee's ability to effectively oversee the program, direct risk mitigation activities, and obtain feedback on the results of its actions.

Committee Decisions Do Not Achieve Desired Outcomes

Best practices call for oversight boards to take corrective actions at the first sign of cost, schedule, and performance slippages in order to mitigate risks and achieve successful outcomes.¹⁰ The NPOESS Executive Committee generally took immediate action to mitigate the risks that were brought before them; however, a majority of these actions were not effective—that is, they did not fully resolve the underlying issues or result in a successful outcome. The Committee's actions on the sensor development risks accomplished interim successes by improving the government's oversight of a subcontractor's activities and guiding next steps in addressing technical issues—but even with Committee actions, the sensors' performance has continued to falter and affect the rest of the program. Independent reviewers reported that the tri-agency structure of

⁹GAO, *Information Technology Investment Management: A Framework for Assessing and Improving Process Maturity*, GAO-04-394G (Washington, D.C.: March 2004).

¹⁰GAO-04-394G.

the program complicated the resolution of sensor risks because any decision could be revisited by another agency. Program officials explained that interagency disagreements and differing priorities make it difficult to effectively resolve issues.

Program Has Assessed Alternatives, but Has Not Yet Identified a Viable Alternative for Acquiring the Last Two NPOESS Satellites

When NPOESS was restructured in June 2006, the program included two satellites (C1 and C2) and an option to have the prime contractor produce the next two satellites (C3 and C4). In approving the restructured program, DOD's decision authority noted that he reserved the right to use a different satellite integrator for the final two satellites, and that a decision on whether to exercise the option was to be made in June 2010. To prepare for this decision, DOD required a tri-agency assessment of alternative management strategies. This assessment was to examine the feasibility of an alternative satellite integrator, to estimate the cost and schedule implications of moving to an alternative integrator, and within one year, to provide a viable alternative to the NPOESS Executive Committee.

To address DOD's requirement, the NPOESS Program Executive Officer sponsored two successive alternative management studies; however, neither of the studies identified a viable alternative to the existing satellite integrator. The Program Executive Officer plans to conduct a final assessment of alternatives prior to the June 2010 decision on whether to exercise the option to have the current system integrator produce the next two NPOESS satellites. Program officials explained that the program's evolving costs, schedules, and risks could mean that an alternative that was not viable in the past would become viable. For example, if the prime contractor's performance no longer meets basic requirements, an alternative that was previously too costly to be considered viable might become so.

Implementation of Recommendations Could Improve Management and Oversight

In the report being released today, we are making recommendations to improve the timeliness and effectiveness of acquisition decision-making on the NPOESS program. Specifically, we recommend that the Secretary of Defense direct the Under Secretary of Defense for Acquisition, Technology, and Logistics to attend and participate in NPOESS Executive Committee meetings. In addition, we are recommending that the Secretaries of Defense and Commerce and the Administrator of NASA direct the NPOESS Executive Committee to take the following five actions: (1) establish a realistic time frame for revising the program's cost and schedule baselines; (2) develop plans to mitigate the risk of gaps in satellite continuity; (3) track the Committee's action items from inception

to closure; (4) improve the Committee's ability to achieve successful outcomes by identifying the desired outcome associated with each of the Committee actions, as well as time frames and responsible parties, when new action items are established; and (5) improve the Committee's efficiency by establishing time frames for escalating risks to the Committee for action so that they do not linger unresolved at the program executive level.

In written comments on a draft of our report, NASA and NOAA agreed with our findings and recommendations and identified plans to implement them. DOD concurred with one and partially concurred with our other recommendations. For example, regarding our recommendation to have the appropriate official attend Executive Committee meetings, the agency partially concurred and noted that the Under Secretary for Acquisition, Technology, and Logistics would evaluate the necessity of attending future Executive Committee meetings. DOD also reiterated that the Under Secretary of the Air Force was delegated authority to attend the meetings. While we acknowledge that the Under Secretary delegated responsibility for attending these meetings, it is an inefficient way to make decisions and achieve outcomes in this situation. In the past, agreements between Executive Committee members have been overturned by the Under Secretary, leading to significant delays in key decisions. The full text of the three agencies' comments and our evaluation of those comments are provided in the accompanying report.

In summary, continued problems in the development of critical NPOESS sensors have contributed to growing costs and schedule delays. Costs are now expected to grow by as much as \$1 billion over the prior life cycle cost estimate of \$13.95 billion, and problems in delivering key sensors have led to delays in launching NPP and the first two NPOESS satellites—by a year or more for NPP and the first NPOESS satellite. These launch delays have endangered our nation's ability to ensure the continuity of polar-orbiting satellite data. Specifically, if any planned satellites fail on launch or in orbit, there would be a gap in satellite data until the next NPOESS satellite is launched and operational—a gap that could last for 3 to 5 years. The NPOESS Executive Committee responsible for making cost and schedule decisions and addressing the many and continuing risks facing the program has not yet made important decisions on program costs, schedules, and risks—or identified when it will do so. In addition, the Committee has not been effective or efficient in carrying out its oversight responsibilities. Specifically, the individual with the authority to make acquisition decisions does not attend Committee meetings, the

Committee does not aggressively manage risks, and many of the Committee's decisions do not achieve desired outcomes. Until the Committee's shortfalls are addressed, important decisions may not be effective and issues involving cost increases, schedule delays, and satellite continuity may remain unresolved.

Mr. Chairman and members of the Subcommittee, this concludes our statement. We would be pleased to respond to any questions that you or other members of the Subcommittee may have at this time.

Contact and Staff Acknowledgments

If you have any questions on matters discussed in this testimony, please contact David A. Powner at (202) 512-9286 or at pownerd@gao.gov. Other key contributors to this testimony include Colleen M. Phillips, Assistant Director; Kate Agatone; Neil Doherty; Kathleen S. Lovett; Lee McCracken; and China R. Williams.

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