



Testimony

Before the House Committee on Science
and Technology, Subcommittee on
Energy and Environment

For Release on Delivery
Expected at 10 a.m. EDT
June 19, 2008

ENVIRONMENTAL
SATELLITES

Polar-orbiting Satellite
Acquisition Faces Delays;
Decisions Needed on
Whether and How to
Ensure Climate Data
Continuity

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



G A O

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Highlights of [GAO-08-899T](#), a testimony before the House Committee on Science and Technology, Subcommittee on Energy and Environment

Why GAO Did This Study

The National Polar-orbiting Operational Environmental Satellite System (NPOESS) is 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)—which has experienced escalating costs, schedule delays, and technical difficulties. These factors led to a June 2006 decision to restructure the program thereby decreasing its complexity, increasing its estimated cost to \$12.5 billion, and delaying the first two satellites by 3 to 5 years.

GAO was asked to summarize a report being released today that evaluates progress in restructuring the acquisition, assesses the status of key program components and risks, and assesses the agencies’ plans for obtaining the data originally planned to be collected by NPOESS sensors, but eliminated by the restructuring.

What GAO Recommends

In its report, GAO recommends that Commerce, DOD, and NASA coordinate to develop plans on whether and how to restore climate and space weather sensors removed from the NPOESS program. GAO also reemphasizes that the appropriate executives finalize and approve key acquisition documents. Agency officials agreed with both recommendations.

To view the full product, including the scope and methodology, click on [GAO-08-899T](#). For more information, contact David A. Powner at (202) 512-9286 or pownerd@gao.gov.

ENVIRONMENTAL SATELLITES

Polar-orbiting Satellite Acquisition Faces Delays; Decisions Needed on Whether and How to Ensure Climate Data Continuity

What GAO Found

The NPOESS program office has completed most of the major activities associated with restructuring the acquisition, but key activities remain to be completed. In the past year, the program redefined the program’s deliverables, costs, and schedules, and renegotiated the NPOESS contract. However, agency executives have not yet finalized selected acquisition documents. Without executive approval, the program lacks the underlying commitment needed to effectively manage a tri-agency program. In addition, given that DOD has stated it would not release fiscal year 2009 funds to the NPOESS program if key acquisition documents are not completed by August 2008, delays in completing these documents could affect the program’s funding and schedule.

In the past year, the NPOESS program has made progress in completing development and testing activities associated with the spacecraft, sensors, and ground systems. However, key milestones have been delayed and multiple risks remain. Specifically, poor workmanship and testing delays caused an 8-month slip in the delivery of a complex imaging sensor called the Visible/infrared imager radiometer suite. This late delivery caused a corresponding 8-month delay in the expected launch date of the NPOESS Preparatory Project demonstration satellite, moving it from late September 2009 to early June 2010. Moving forward, risks remain in completing the testing of key sensors and integrating them on the spacecraft, resolving interagency disagreements about the appropriate level of system security, and revising outdated operations and support cost estimates—which program officials say could increase the lifecycle cost by about \$1 billion. The program office is aware of these risks and is working to mitigate them, but these issues could affect the program’s overall schedule and cost.

When the NPOESS restructuring agreement removed four climate and space environment sensors from the program and degraded four others, it led NASA, NOAA, and DOD to reassess their priorities and options for obtaining climate and space environment data. Since the June 2006 restructuring decision, the three agencies have taken preliminary steps to restore the capabilities of selected climate and space weather sensors that were removed from the NPOESS program by prioritizing the sensors, assessing options for restoring them, and making decisions to mitigate near-term data continuity needs by restoring two sensors to the demonstration satellite and one sensor to the first NPOESS satellite. However, the agencies have not yet developed plans on whether and how to replace sensors on a long-term basis as no plans have been made for sensors or satellites after the first satellite of the program. Until such a plan is developed, the agencies may lose their windows of opportunity for selecting cost-effective options or they may resort to an ad hoc approach to restoring these sensors. Almost 2 years have passed since key sensors were removed from the NPOESS program; further delays in establishing a plan could result in gaps in the continuity of climate and space data.

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Mr. Chairman and Members of the Subcommittee:

We appreciate the opportunity to participate in today's hearing to discuss our work on the \$12.5 billion dollar National Polar-orbiting Operational Environmental Satellite System (NPOESS) program. NPOESS is expected to be a state-of-the-art, environment-monitoring satellite system that will replace two existing polar-orbiting environmental satellite systems. 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. The NPOESS program 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 through the year 2026.

Three agencies share responsibility for the NPOESS program: 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). To manage the NPOESS program, these agencies established a tri-agency integrated program office. In recent years, the program has experienced escalating costs, schedule delays, and technical difficulties, which led to a June 2006 decision to restructure it. This decision decreased the complexity of the program by reducing the number of satellites and sensors, increased the estimated cost of the program to \$12.5 billion, and delayed the launches of the first two satellites by 3 and 5 years, respectively.

As requested, this statement summarizes our report being released today that (1) evaluates the NPOESS program office's progress in restructuring the acquisition, (2) assesses the status of key program components and risks, (3) and assesses NASA's, NOAA's, and DOD's plans for obtaining the environmental data originally planned to be

collected by NPOESS sensors, but then eliminated by the restructuring.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. In addition, we updated factual information on sensors and due dates as warranted. All the work on which this testimony is based was performed in accordance with generally accepted government auditing standards.

Results in Brief

The NPOESS program office has completed most of the major activities associated with restructuring the acquisition, but key activities remain to be completed. In the past year, the program redefined the program's deliverables, costs, and schedules, and renegotiated the NPOESS contract. However, agency executives have not yet finalized selected acquisition documents, including the tri-agency memorandum of agreement and the acquisition program baseline. In April 2007, we reported that key acquisition documents were already over six months late and recommended that agency officials complete them immediately.² Agency officials subsequently extended the due dates of the documents. Moreover, although DOD has had a role in delaying their completion, the Department has stated it would not release fiscal year 2009 funds to the NPOESS program if key acquisition documents are not completed by August 2008. Without executive approval of the memorandum of agreement and other key documents, the program lacks the underlying commitment needed to effectively manage a tri-agency program. In addition, given DOD's recent instructions, any further delays in completing these documents could affect the program's funding and schedule.

¹ GAO, *Environmental Satellites: Polar-orbiting Satellite Acquisition Faces Delay; Decisions Needed on Whether and How to Ensure Climate Data Continuity*, [GAO-08-518](#) (Washington, D.C.: May 16, 2008).

² GAO, *Polar-orbiting Operational Environmental Satellites: Restructuring is Under Way, but Technical Challenges and Risks Remain*, [GAO-07-498](#) (Washington, D.C.: April 27, 2007).

In the past year, the NPOESS program has made progress in completing development and testing activities associated with the spacecraft, sensors, and ground systems. However, key milestones have been delayed and multiple risks remain. Specifically, poor workmanship and testing delays caused an 8-month slip in the delivery of a complex imaging sensor called the Visible/infrared imager radiometer suite. This late delivery caused a corresponding 8-month delay in the expected launch date of the NPOESS Preparatory Project demonstration satellite, moving it from late September 2009 to early June 2010. Any delay in this launch date shortens the time available for identifying lessons learned from the demonstration satellite while it is in orbit and incorporating these lessons in the development of the first NPOESS satellite. Such delays could also lead to gaps in weather and climate data continuity if existing satellites begin to degrade or fail. Moving forward, risks remain in completing the testing of key sensors and integrating them on the spacecraft, resolving interagency disagreements about the appropriate level of system security, and revising outdated operations and support cost estimates—which program officials say could increase the lifecycle cost by about \$1 billion. The program office is aware of these risks and is working to mitigate them, but these issues could affect the program’s overall schedule and cost.

When the NPOESS restructuring agreement removed four climate and space environment sensors from the program and degraded four others, it led NASA, NOAA, and DOD to reassess their priorities and options for obtaining climate and space environment data. Since the June 2006 restructuring decision, the three agencies have taken preliminary steps to restore the capabilities of selected climate and space weather sensors that were removed from the NPOESS program by prioritizing the sensors, assessing options for restoring them, and making decisions to mitigate near-term data continuity needs by restoring two sensors to the demonstration satellite and one sensor to the first NPOESS satellite. However, the agencies have not yet developed plans on whether and how to ensure climate and space weather data on a long-term basis as no plans have been made for sensors or satellites after the first satellite of the program. Until such a plan is developed, the agencies may lose their windows of opportunity for selecting cost-effective options or they may resort

to an ad hoc approach to restoring these sensors. Almost 2 years have passed since key sensors were removed from the NPOESS program; further delays in establishing a plan could result in gaps in the continuity of climate and space data.

In our report, we made recommendations to all three agencies to establish plans on whether and how to restore the climate and space sensors removed from the NPOESS program by June 2009, in cases where the sensors are warranted and justified. In addition, we also reemphasized a recommendation made in our prior report³ that the appropriate NASA, NOAA, and DOD executives immediately finalize key acquisition documents. All three agencies concurred with these recommendations.

Background

Since the 1960s, the United States has operated two separate operational polar-orbiting meteorological satellite systems: the Polar-orbiting Operational Environmental Satellite (POES) series—managed by NOAA—and the Defense Meteorological Satellite Program (DMSP)—managed by the Air Force. These satellites obtain environmental data that are processed to provide graphical weather images and specialized weather products—including both terrestrial and space weather. These satellite data are also the predominant input to numerical weather prediction models, which are a primary tool for forecasting weather 3 or more days in advance—including forecasting the path and intensity of hurricanes. The 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 their effects. Polar satellites also provide data used to monitor environmental phenomena, such as ozone depletion and drought conditions, as well as data sets that are used by researchers for a variety of studies such as climate monitoring.

³ [GAO-07-498](#).

NPOESS Overview

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.⁴ 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 through the year 2026. 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; DOD 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 costs of funding NPOESS, while NASA funds specific technology projects and studies. The NPOESS program office is overseen by an Executive Committee, which is made up of the Administrators of NOAA and NASA and the Under Secretary of the Air Force.

NPOESS is a major system acquisition that was originally estimated to cost about \$6.5 billion over the 24-year life of the program from its inception in 1995 through 2018. The program is to provide satellite development, satellite launch and operation, and ground-based satellite data processing. These deliverables are grouped into four main categories: (1) the space segment, which includes the satellites and sensors; (2) the integrated data processing segment, which is the system for transforming raw data into environmental data records (EDR) and is to be located at four data processing centers; (3) the command, control, and communications segment, which includes the equipment and services needed to support satellite operations; and (4) the launch segment, which includes launch vehicle services.

⁴ Presidential Decision Directive NSTC-2, May 5, 1994

When the NPOESS engineering, manufacturing, and development contract was awarded in August 2002, the cost estimate was adjusted to \$7 billion. Acquisition plans called for the procurement and launch of six satellites over the life of the program, as well as the integration of 13 instruments—consisting of 10 environmental sensors and 3 subsystems. Together, the sensors were to receive and transmit data on atmospheric, cloud cover, environmental, climatic, oceanographic, and solar-geophysical observations. The subsystems were to support non-environmental search and rescue efforts, sensor survivability, and environmental data collection activities. The program office considered 4 of the sensors to be critical because they provide data for key weather products; these sensors are in bold in table 1, which describes each of the expected NPOESS instruments.

Table 1: Expected NPOESS Instruments, as of August 31, 2004 (critical sensors are in bold)

Instrument	Description
Advanced technology microwave sounder	Measures microwave energy released and scattered by the atmosphere and is to be used with infrared sounding data from the cross-track infrared sounder to produce daily global atmospheric temperature, humidity, and pressure profiles
Aerosol polarimetry sensor	Retrieves specific measurements of clouds and aerosols (liquid droplets or solid particles suspended in the atmosphere, such as sea spray, smog, and smoke)
Conical-scanned microwave imager/sounder	Collects microwave images and data needed to measure rain rate, ocean surface wind speed and direction, amount of water in the clouds, and soil moisture, as well as temperature and humidity at different atmospheric levels
Cross-track infrared sounder	Collects measurements of the earth's radiation to determine the vertical distribution of temperature, moisture, and pressure in the atmosphere
Data collection system	Collects environmental data from platforms around the world and delivers them to users worldwide
Earth radiation budget sensor	Measures solar short-wave radiation and long-wave radiation released by the earth back into space on a worldwide scale to enhance long-term climate studies
Ozone mapper/profiler suite	Collects data needed to measure the amount and distribution of ozone in the earth's atmosphere. Consists of two components (limb and nadir), which can be provided separately
Radar altimeter	Measures variances in sea surface height/topography and ocean surface roughness, which are used to determine sea surface height, significant wave height, and ocean surface wind speed and to provide critical inputs to ocean forecasting and climate prediction models
Search and rescue satellite aided tracking system	Detects and locates aviators, mariners, and land-based users in distress
Space environmental sensor suite	Collects data to identify, reduce, and predict the effects of space weather on technological systems, including satellites and radio links
Survivability sensor	Monitors for attacks on the satellite and notifies other instruments in case of an attack
Total solar irradiance sensor	Monitors and captures total and spectral solar irradiance data
Visible/infrared imager radiometer suite (VIIRS)	Collects images and radiometric data used to provide information on the earth's clouds, atmosphere, ocean, and land surfaces

Source: GAO analysis of NPOESS program office data.

In addition, a demonstration satellite, called the NPOESS Preparatory Project (NPP), was planned to be launched several years before the first NPOESS satellite in order to reduce the risk associated with launching new sensor technologies and to ensure continuity of climate data with NASA's Earth Observing System satellites. NPP was to host three of the four critical NPOESS sensors, as well as one other noncritical sensor and to provide the program office and the processing centers an early opportunity to work with the sensors, ground control, and data processing systems.⁵

When the NPOESS development contract was awarded, the schedule for launching the satellites was driven by a requirement that the satellites be available to back up the final POES and DMSP satellites should anything go wrong during the planned launches of these satellites. Early program milestones included (1) launching NPP by May 2006, (2) having the first NPOESS satellite available to back up the final POES satellite launch in March 2008, and (3) having the second NPOESS satellite available to back up the final DMSP satellite launch in October 2009. If the NPOESS satellites were not needed to back up the final predecessor satellites, their anticipated launch dates would have been April 2009 and June 2011, respectively.

⁵The four sensors are the Visible/infrared imager radiometer suite, the Cross-track infrared sounder, the Advanced technology microwave sounder, and the Ozone mapper/profiler suite.

NPOESS Experienced Cost Increases, Schedule Delays, and Technical Problems That Led to Decision to Restructure the NPOESS Program

Over several years, we reported that NPOESS had experienced continued cost increases, schedule delays, and serious technical problems.⁶ By November 2005, we estimated that the cost of the program had grown from \$7 billion to over \$10 billion. In addition, the program was experiencing major technical problems with the VIIRS sensor and expected to delay the launch date of the first satellite by almost 2 years. These issues ultimately required difficult decisions to be made about the program's direction and capabilities. The Nunn-McCurdy law requires DOD to take specific actions when a major defense acquisition program cost growth exceeds certain thresholds.⁷ The law requires the Secretary of Defense to notify Congress when a major defense acquisition is expected to overrun its current baseline by 15 percent or more and to certify the current program to Congress when it is expected to overrun its baseline by 25 percent or more.⁸ In November 2005, NPOESS exceeded the 25 percent threshold, and DOD was required to certify the program. Certifying a program entails providing a determination that (1) the program is essential to national security, (2) there are no alternatives to the program that will provide equal or greater military capability at less cost, (3) the new estimates of the program's cost are reasonable, and (4) the management structure for the program is adequate to manage and control costs. DOD established tri-agency teams—made up of DOD, NOAA, and NASA

⁶GAO, *Polar-orbiting Operational Environmental Satellites: Cost Increases Trigger Review and Place Program's Direction on Hold*, [GAO-06-573T](#) (Washington, D.C.: Mar. 30, 2006); GAO, *Polar-orbiting Operational Environmental Satellites: Technical Problems, Cost Increases, and Schedule Delays Trigger Need for Difficult Trade-off Decisions*, [GAO-06-249T](#) (Washington, D.C.: Nov. 16, 2005); GAO, *Polar-orbiting Environmental Satellites: Information on Program Cost and Schedule Changes*, [GAO-04-1054](#) (Washington, D.C.: Sept. 30, 2004); GAO, *Polar-orbiting Environmental Satellites: Project Risks Could Affect Weather Data Needed by Civilian and Military Users*, [GAO-03-987T](#) (Washington, D.C.: July 15, 2003); and GAO, *Polar-orbiting Environmental Satellites: Status, Plans, and Future Data Management Challenges*, [GAO-02-684T](#) (Washington, D.C.: July 24, 2002).

⁷10 U.S.C. § 2433 is commonly referred to as Nunn-McCurdy.

⁸10 U.S.C. § 2433 has recently been amended by Pub. L. No. 109-163, § 802 (Jan. 6, 2006) and Pub. L. No. 109-364, § 213(a) (Oct. 17, 2006). The law now also includes cost growth thresholds from the program's original baseline.

experts—to work on each of the four elements of the certification process.

In June 2006, DOD (with the agreement of both of its partner agencies) certified a restructured NPOESS program, estimated to cost \$12.5 billion through 2026.⁹ This decision approved a cost increase of \$4 billion over the prior approved baseline cost and delayed the launch of NPP and the first 2 satellites by roughly 3 to 5 years. The new program also entailed reducing the number of satellites to be produced and launched from 6 to 4, and reducing the number of instruments on the satellites from 13 to 9—consisting of 7 environmental sensors and 2 subsystems. It also entailed using NPOESS satellites in the early morning and afternoon orbits and relying on European satellites for midmorning orbit data.¹⁰ Table 2 summarizes the major program changes made under the Nunn-McCurdy certification decision.

⁹ DOD estimated that the acquisition portion of the certified program would cost \$11.5 billion. The acquisition portion includes satellite development, production, and launch, but not operations and support costs after launch. When combined with an estimated \$1 billion for operations and support after launch, this brings the program life cycle cost to \$12.5 billion.

¹⁰ The European Organization for the Exploitation of Meteorological Satellites' MetOp program is a series of three polar-orbiting satellites dedicated to operational meteorology. MetOp satellites are planned to be launched sequentially over 14 years. The first of these satellites was launched in 2006 and is currently operational.

Table 2: Summary of Changes to the NPOESS Program, as of June 2006

Key area	Program before the Nunn-McCurdy decision	Program after the Nunn-McCurdy decision
Life cycle range	1995-2020	1995-2026
Estimated life cycle cost	\$8.4 billion	\$12.5 billion
Launch schedule	NPP by October 2006 First NPOESS by November 2009 Second NPOESS by June 2011	NPP by January 2010 ^a First NPOESS by January 2013 Second NPOESS by January 2016
Management structure	System Program Director reports to a tri-agency steering committee and a tri-agency Executive Committee Independent program reviews noted insufficient system engineering and cost analysis staff	System Program Director is responsible for day-to-day program management and reports to the Program Executive Officer Program Executive Officer oversees program and reports to the tri-agency Executive Committee
Number of satellites	6 (in addition to NPP)	4 (in addition to NPP)
Number of orbits	3 (early morning, midmorning, and afternoon)	2 (early morning and afternoon; will rely on European satellites for midmorning orbit data)
Number and complement of instruments	13 instruments (10 sensors and 3 subsystems)	9 instruments (7 sensors and 2 subsystems); 4 of the sensors are to provide fewer capabilities
Number of EDRs	55	39 (6 are to be degraded products)

Source: GAO analysis of NPOESS program office data.

^aAlthough the Nunn-McCurdy certification decision specifies NPP is to launch by January 2010, NASA planned to launch it by September 2009 to reduce the possibility of a climate data continuity gap.

The Nunn-McCurdy certification decision established new milestones for the delivery of key program elements, including launching NPP by January 2010, launching the first NPOESS satellite by January 2013, and launching the second NPOESS satellite by January 2016. These revised milestones deviated from prior plans to have the first NPOESS satellite available to back up the final POES satellite should anything go wrong during that launch.

Delaying the launch of the first NPOESS satellite meant that if the final POES satellite fails on launch, satellite data users would need to rely on the existing constellation of environmental satellites until NPP data becomes available—almost 2 years later. Although NPP was not intended to be an operational asset, NASA agreed to move NPP to a different orbit so that its data would be available in the event of a premature failure of the final POES satellite. If the health of the existing constellation of satellites diminishes—or if NPP data

is not available, timely, and reliable—there could be a gap in environmental satellite data.

In order to reduce program complexity, the Nunn-McCurdy certification decision decreased the number of NPOESS sensors from 13 to 9 and reduced the functionality of 4 sensors. Specifically, of the 13 original sensors, 5 sensors remain unchanged (but 2 are on a reduced number of satellites), 3 were replaced with older or less capable sensors, 1 was modified to provide less functionality, and 4 were canceled. The certification decision also made allowances for the reintegration of the cancelled sensors. Specifically, the program was directed to build each NPOESS spacecraft with enough room and power to accommodate the sensors that were removed from the program and to fund the integration and testing of any sensors that are later restored. Agency sponsors external to the program would be responsible for justifying and funding the sensor's development, while the NPOESS Executive Committee would have the final decision on whether to include the sensor on a specific satellite. Table 3 identifies the changes to the NPOESS instruments.

Table 3: Changes to NPOESS Instruments (critical sensors in bold)

Instrument	Status of instrument after Nunn-McCurdy Decision
Advanced technology microwave sounder	Sensor unchanged; to be included on NPP and on afternoon satellites
Aerosol polarimetry sensor	Sensor was canceled ^a
Conical-scanned microwave imager/sounder	Sensor was canceled; program office to procure a less complex microwave imager/sounder for inclusion beginning on the second NPOESS satellite
Cross-track infrared sounder	Sensor unchanged; to be included on NPP and on afternoon satellites
Data collection system	No change; subsystem is to be included on all four NPOESS satellites
Earth radiation budget sensor	Sensor was canceled; is to be replaced by a legacy sensor ^a
Ozone mapper/profiler suite	One part of the sensor (OMPS-Limb) was canceled; remaining part is to be included on NPP and on all four NPOESS satellites ^a
Radar altimeter	Sensor was canceled ^a
Search and rescue satellite aided tracking system	Sensor unchanged; subsystem is to be included on all four NPOESS satellites
Space environmental sensor suite	Sensor was canceled; is to be replaced by a less capable, less expensive legacy sensor ^a
Survivability sensor	Subsystem was canceled ^a
Total solar irradiance sensor	Sensor was canceled ^a
Visible/infrared imager radiometer suite	Sensor unchanged; sensor is to be included on NPP and on all four NPOESS satellites

Source: GAO analysis of NPOESS program office data.

^a While direct program funding for these sensors was eliminated, these sensors could be reintegrated should other parties choose to fund them. The Nunn-McCurdy certification decision notes that the spacecraft is to include space for these sensors and funds to integrate them.

The changes in NPOESS sensors affected the number and quality of the resulting weather and environmental products, called environmental data records (EDR). In selecting sensors for the restructured program during the Nunn-McCurdy process, decision makers placed the highest priority on continuing current operational weather capabilities and a lower priority on obtaining selected environmental and climate measuring capabilities. As a result, the revised NPOESS system has significantly less capability for providing global climate measures than was originally planned. Specifically, the number of EDRs was decreased from 55 to 39, of which 6 are of a reduced quality. The 39 EDRs that remain include cloud base height, land surface temperature, precipitation type and rate, and sea surface winds. The 16 EDRs that were removed include cloud particle size and distribution, sea surface height, net solar radiation at the top of the atmosphere, and products to depict the electric fields in the space environment. The 6 EDRs that are of a reduced quality include ozone profile, soil moisture, and multiple products depicting energy in the space environment.

Major Restructuring Activities Have Been Completed, but Key Remaining Activities Could Affect Funding and Schedule

The program office has completed major activities associated with restructuring NPOESS, but key supporting activities remain—including obtaining approval of key acquisition documents—and delays in completing these activities could affect the program’s funding and schedule. Restructuring a major acquisition program like NPOESS is a process that involves reassessing and redefining the program’s deliverables, costs, and schedules, and renegotiating the contract. The restructuring process also involves revising important acquisition documents such as the tri-agency memorandum of agreement, the acquisition strategy, the system engineering plan, the integrated master schedule defining what needs to happen by when, and the acquisition program baseline. In April 2007, we reported that the key acquisition documents were over six months late from their original September 2006 due date, and we recommended that the appropriate executives immediately finalize them.¹¹ This recommendation has not yet been addressed and agency officials subsequently extended the due dates of the documents to September 2007.

During the past year, the program redefined the program’s deliverables, costs, and schedules, and renegotiated the NPOESS contract. To do so, the program developed a new program plan and conducted an integrated baseline review of the entire program, which validated that the new deliverables, costs, and schedules were feasible. It also completed key acquisition documents including the system engineering plan and the integrated master schedule. The program and the prime contractor signed a modified contract in July 2007.

However, key activities remain to be completed, including obtaining executive approval of key acquisition documents. Specifically, even though agency officials were expected to approve key acquisition documents by September 2007, the appropriate executives have not

¹¹ [GAO-07-498](#).

yet signed off on documents including the tri-agency memorandum of agreement or the acquisition strategy report. They have also not signed off on the acquisition program baseline, the fee management plan, the test and evaluation master plan, and the two-orbit program plan (a plan for how to use European satellite data with NPOESS).

Program officials stated that the program has been able to renegotiate the contract and to proceed in developing sensors and systems without these documents being signed because the documents have widespread acceptance within the three agencies. They reported that the delays are largely due to the complexity of obtaining approval from three agencies. For example, program officials reported that an organization within DOD suggested minor changes to the tri-agency memorandum of agreement after months of coordination and after it had already been signed by both the Secretary of Commerce and the Administrator of NASA. Further, after this issue was resolved, a senior official at DOD requested another change to the document. The program office has now made the recommended changes and is re-initiating the coordination process.

More recently, in April 2008, DOD moved the due dates for all of the acquisition documents other than the memorandum of agreement and fee management plan from September 2007 to August 31, 2008. (See appendix I for the history of the due dates and status of each document). In addition, even though DOD has had a role in delaying these documents, the Department has stated it would not release fiscal year 2009 funds to the program if these acquisition documents are not completed by the new due date. Without executive approval of key acquisition documents, the program lacks the underlying commitment necessary to effectively manage a tri-agency program. In addition, given DOD's newest instructions, any further delays in completing these acquisition documents could affect the program's funding and schedule.

Program Has Made Progress, but Key Milestones Have Been Delayed and Risks Remain

Over the last year, the NPOESS program has made progress by completing planned development and testing activities on its ground and space segments, but key milestones for delivering the VIIRS sensor and launching NPP have been delayed by about 8 months. Moving forward, risks remain in completing the testing of key sensors and integrating them on the NPP spacecraft, in resolving interagency disagreements on the appropriate level of system security, and in revising estimated costs for satellite operations and support. The program office is aware of these risks and is working to mitigate them, but continued problems could affect the program's overall schedule and cost. Given the tight time frames for completing key sensors, integrating them on the NPP spacecraft, and getting the ground-based data processing system developed, tested, and deployed, it is important for the NPOESS Integrated Program Office, the Program Executive Office, and the Executive Committee to continue to provide close oversight of milestones and risks.

Ground Segment—Progress Made but Important Work Remains to Be Done

Development of the ground segment—which includes the interface data processing system, the ground stations that are to receive satellite data, and the ground-based command, control, and communications system—is under way and on track. For example, the Interface Data Processing System has been installed at one of the two locations that are to receive NPP data, and the command, control, and communications system passed acceptance testing for use with NPP. However, important work in developing the algorithms that translate satellite data into weather products within the integrated data processing segment remains to be completed. Table 4 describes each of the components of the ground segment and identifies the program-provided risk level and status of each.

Table 4: Status of Ground Segment Components

Ground segment component/ description	Program- identified risk level	Status
<p>Interface Data Processing System (IDPS)—</p> <p>A ground-based system that is to process the sensors' data so that they are usable by the data processing centers and the broader community of environmental data users. IDPS will be deployed at the four weather data processing centers.</p>	Low	<p>IDPS software is being developed in a series of builds. In 2007, software developers required additional resources and fell behind schedule on build 1.5 activities due to unanticipated complexities in developing algorithms that will make use of data collected by the Ozone mapper/profiler suite in orbit—as well as late delivery of key information on this instrument.</p> <p>As of January 2008, IDPS build 1.5 had been developed and was undergoing testing to check the quality of its performance; additional builds are planned to be developed prior to launch and will be used with NPP.</p> <p>In January 2008, IDPS hardware was installed at one of the data processing centers (NOAA's National Satellite Operations Facility in Suitland, Maryland) and is expected to be installed at the Air Force Weather Agency this summer. In addition, the Air Force Weather Agency has begun early testing of NPOESS data. Site acceptance testing for NPP is scheduled to be completed in December 2008.</p>
<p>Ground stations for receiving satellite data—</p> <p>15 unmanned ground stations around the world (called SafetyNet™) are to receive satellite data and send it to the four data processing centers.</p>	Low	<p>NOAA is working with domestic and foreign authorities to obtain approval to operate ground stations to receive satellite data. According to agency officials, the full complement of ground stations will not be in place in time for the first NPOESS satellite launch. The ground stations will be phased in by the launch of the second satellite. To date, the program office has reached agreement with 4 of 15 ground station sites.</p>
<p>Command, control, and communications segment—</p> <p>Performs the day-to-day monitoring and command of the spacecraft and sensors</p>	Low	<p>The command, control, and communications segment is being developed in a series of builds. In August 2007, build 1.4 transitioned from development to operations and support. In addition, the command, control, and communications acceptance testing for NPP has been completed.</p>

Source: GAO summary of NPOESS program office data.

Space Segment—Progress Made, but One Sensor Was Delayed and Sensors Continue to Face Risks

Over the past year, the program made progress on the development of the space segment, which includes the sensors and the spacecraft. Five sensors are of critical importance because they are

to be launched on the NPP satellite.¹² Initiating work on another sensor, the Microwave Imager Sounder, is also important because this new sensor—which is to replace the canceled Conical-scanned microwave imager/sounder sensor—will need to be developed in time for the second NPOESS satellite launch. Among other activities, the program has successfully completed vibration testing of the flight unit of the Cross-track infrared sounder (CrIS), a major pre-environmental testing review for the VIIRS instrument, integration and risk reduction testing of the flight unit of the Ozone mapper/profiler suite, and thermal testing of the NPP spacecraft with three sensors on board.¹³ In addition, the program made decisions on how to proceed with the Microwave imager sounder and recently awarded a contract to a government laboratory for its development.

However, the program experienced problems on VIIRS, including poor workmanship on selected subcomponents and delays in completing key tests. These issues delayed VIIRS delivery to the NPP contractor by 8 months. This late delivery will in turn delay the satellite's launch from late September 2009 to early June 2010. This delay shortens the time available for incorporating lessons learned from NPP while it is in orbit into future NPOESS missions and could lead to gaps in the continuity of climate and weather data if predecessor satellites fail prematurely. Also, the CrIS sensor experienced a cost overrun and schedule delays as the contractor worked to recover from a structural failure and is currently several weeks behind its schedule due to thermal vacuum testing taking longer than planned. The status and risk level of each of the components of the space segment is described in table 5.

¹²NPP is to include the Visible/infrared imager radiometer suite, Cross-track infrared sounder, Advanced technology microwave sounder, Ozone mapper/profiler suite (nadir and limb), and the Clouds and the earth's radiant energy system.

¹³ The three sensors included the flight unit for the Advanced technology microwave sounder and engineering design units for the Visible/infrared imager radiometer suite and the Cross-track infrared sounder.

Table 5: Status of Selected Components of the Space Segment, as of May 2008

Space segment component	Program-identified risk level	Status
Visible/infrared imager radiometer suite (VIIRS)	High	<p>In April 2007, we reported that the contractor had identified a problem with the VIIRS baseline filter during environmental testing that caused degraded performance in the filter's image quality. Specifically, this problem involves light leaking across the seams of the filter, resulting in inaccurate measurements of ocean color. In October 2007, the NPOESS Executive Committee decided to continue sensor development with the baseline filter because changing it would increase risks to sensor development, delay the delivery of the sensor, and risk delays to the launch of NPP. An improved VIIRS filter is planned to be included on the flight units on future NPOESS missions.</p> <p>More recently, the VIIRS contractor experienced problems with workmanship on electrical and cryoradiator components and delays in executing tests.^a These factors slowed the sensor's development.</p> <p>The VIIRS flight unit was originally scheduled to be delivered to NPP by July 2008, but due to technical issues and testing schedule delays, VIIRS' delivery to NPP is now planned for April 2009.</p>
Cross-track infrared sounder (CrIS)	Moderate	<p>In April 2007, we reported that development of CrIS was put on hold in October 2006 when the flight unit designated to go on NPP experienced a major structural failure during its vibration testing. Acceptance testing began again in mid-2007, and the structural stability of the frame was approved in August 2007. The flight unit is currently undergoing thermal vacuum testing—which has taken longer than planned. The flight unit was expected to be delivered to NPP by May 2008, but it is now expected to be delivered in August 2008.</p>
Ozone mapper/profiler suite (nadir and limb)	Low	<p>In April 2007, program officials had agreed to fund the reintegration of the limb component on NPP. The first flight unit completed key integration risk reduction testing and is expected to be delivered to the NPP contractor for integration in August 2008.</p>
Advanced technology microwave sounder	Low	<p>The flight unit for NPP was developed by a NASA contractor and delivered to the program in October 2005. The NPP contractor integrated the flight unit on the spacecraft in December 2006 and is awaiting delivery of the other sensors in order to complete integration testing.</p>
Clouds and the earth's radiant energy system	Not yet rated	<p>In January 2008, the NPOESS Executive Committee approved including this instrument on NPP. The sensor has already been built but requires some refurbishment. It is expected to be delivered to the NPP spacecraft for integration in October 2008. In January 2008, the program office was directed to develop an additional sensor for the first NPOESS satellite.</p>
Microwave imager/sounder	Low	<p>A new microwave imager/sounder sensor is being planned to replace the canceled Conical-scanned microwave imager/sounder. In May 2008, the program office selected the U.S. Naval Research Lab to develop the sensor for the second NPOESS satellite. If it is more cost effective to do so, the program office plans to move production of the second and third MIS sensors to a contractor.</p>
Spacecraft	Low	<p>Both the development of the spacecraft for NPP and the spacecraft for NPOESS are on track.</p> <ul style="list-style-type: none"> • The NPP spacecraft was completed in June 2005. The NPP contractor has completed over a year's worth of risk reduction activities, which included thermal testing of the spacecraft with three of the sensors on board. • The critical design review of the first NPOESS spacecraft is scheduled to be completed in April 2009, with the launch date scheduled for January 2013.

Source: GAO analysis of NPOESS Integrated Program Office data.

^a The cryoradiator is a key component of the VIIRS sensor. It is intended to cool down components of the sensor.

Program Risks Remain; Continued Oversight Is Needed to Prevent Further Cost Increases and Schedule Delays

Moving forward, the program continues to face risks. Over the next 2 years, it will need to complete the development of the key sensors, test them, integrate and test them on the NPP spacecraft, and test these systems with the ground-based data processing systems. In addition, the program faces two other issues that could affect its overall schedule and cost. One is that there continues to be disagreement between NOAA and DOD on the appropriate level of system security. To date, NPOESS has been designed and developed to meet DOD's standards for a mission essential system, but NOAA officials believe that the system should be built to meet more stringent standards.¹⁴ Implementing more stringent standards could cause rework and retesting, and potentially affect the cost and schedule of the system. Another issue is that program life cycle costs could increase once a better estimate of the cost of operations and support is known. The \$12.5 billion estimated life cycle cost for NPOESS includes a rough estimate of \$1 billion for operations and support.

The NPOESS program office is working closely with the contractor and subcontractors to resolve these program risks. To address sensor risks, the program office and officials from NASA's Goddard Space Flight Center commissioned an independent review team to assess the thoroughness and adequacy of practices being used in the assembly, integration, and testing of the VIIRS and CrIS instruments in preparation for the NPP spacecraft. The team found that the contractors for both sensors had sound test programs in place, but noted risks with VIIRS's schedule and with CrIS's reliability and performance. The program office adjusted the VIIRS testing schedule and is monitoring the CrIS testing results. In addition, the program office recently instituted biweekly senior-level management meetings to review progress on VIIRS's development, and program officials noted that both the prime contractor and the program executive office will have senior officials onsite at the

¹⁴ NOAA officials have stated that they believe the program should be built to a "high" security level per Federal Information Processing Standards Publication 199.

contractor's facility to provide extensive, day-to-day oversight of management activities to assist in resolving issues.

To address the risk posed by changing security requirements late in the system's development, program officials commissioned a study to determine the effect of more stringent standards on the system. This study was completed in March 2008, but has not yet been released. To address the risk of cost growth due to poor estimates of operations and support costs, DOD's cost analysis group is currently refining this estimate. Program officials estimated that the program costs could grow by about \$1 billion, and expect to finalize revised operations and support costs in July 2008.

The program office is aware of program risks and is working to mitigate them, but these issues could affect the program's overall schedule and cost. Given the tight time frames for completing key sensors, integrating them on the NPP spacecraft, and getting the ground-based data processing system developed, tested, and deployed, it is important for the NPOESS program office, the Program Executive Office, and the Executive Committee to continue to provide close oversight of milestones and risks.

Agencies Have Undertaken Preliminary Steps to Restore Key Sensors, but Lack Timely Plans to Ensure Long-Term Data Continuity

When the NPOESS restructuring agreement removed four climate and space environment sensors from the program and degraded four others, it led NASA, NOAA, and DOD to reassess their priorities and options for obtaining climate and space environment data. Since the June 2006 restructuring decision, the three agencies have taken preliminary steps to restore the capabilities of selected climate and space weather sensors that were degraded or removed from the NPOESS program by prioritizing the sensors, assessing options for restoring them, and making decisions to restore selected sensors in order to mitigate near-term data gaps. However, the agencies have not yet developed plans to mitigate the loss of these sensors on a long-term basis. Best practices in strategic planning suggest that

agencies develop and implement long-term plans to guide their short-term activities. Until such plans are developed, the agencies may lose their windows of opportunity for selecting cost-effective options or they may resort to an ad hoc approach to restoring these sensors. Lacking plans almost 2 years after key sensors were removed from the NPOESS program, the agencies face increased risk of gaps in the continuity of climate and space environment data.

While NPOESS was originally envisioned to provide only weather observations, this mission was later expanded to include long-term continuity for key climate data. Maintaining the continuity of climate and space data over decades is important to identify long-term environmental cycles (such as the 11-year solar cycle and multiyear ocean cycles including the El Niño effect) and their impacts, and to detect trends in climate change and global warming. The Nunn-McCurdy restructuring decision removed four sensors and degraded the functionality of four other sensors that were to provide these data. DOD, NASA, and NOAA are now responsible for determining what to restore, how to restore it, and the means for doing so. This responsibility includes justifying the additional funding needed to develop these sensors within their respective agencies' investment decision processes. Best practices of leading organizations call for defining a strategic plan to formalize priorities and plans for meeting mission goals. Such a plan would include the agency's long-term goals for climate and space weather measurements, the short-term activities needed to attain these goals, and the milestones and resources needed to support the planned activities.

NASA, NOAA, and DOD Have Identified Priorities, Assessed Options, and Made Decisions to Restore Selected Sensors

Since the June 2006 restructuring, NASA, NOAA, and DOD have taken preliminary steps to restore sensor capabilities by determining priorities for restoring sensor capabilities, assessing options for obtaining sensor data over time, and making decisions to restore selected sensors. Specifically, in August 2006, the NPOESS Senior User Advisory Group—a group representing NASA, NOAA, and DOD system users—assessed the impact of the canceled or degraded sensors and identified priorities for restoring them. In January 2007, a NOAA and NASA working group on climate sensors

prioritized which of the sensors were most important to restore for climate purposes and proposed possible solutions and mitigation efforts. Two other groups—the National Research Council and a NOAA-DOD working group—have also issued reports describing the impact of the loss of climate and space environmental sensors, respectively.¹⁵ Table 6 summarizes the results of these studies.

Table 6: Summary of Studies on Impacts of the Loss of Sensors and Priorities for Restoring Them

Sensor/ Description	Likely impact of sensor loss	Climate Working Group's priority for restoration	NPOESS Advisory Group's priority for restoration
Aerosol polarimetry sensor	<ul style="list-style-type: none"> •Decreased ability to improve air quality monitoring over time •Decreased ability to improve understanding of aerosol's impact on the earth's radiation budget; that is, whether aerosols play a role in global warming •Decreased ability to study the global distribution of aerosols and the impact of aerosols on climate •Decreased ability to improve military munitions targeting and intelligence collection 	6	7
Conical-scanned microwave imager/sounder, to be replaced by the Microwave imager/sounder	<ul style="list-style-type: none"> •Cancellation of the Conical-scanned microwave imager/sounder raised concerns about the loss of critical environmental data including sea surface temperatures, ice and snow cover, and ocean surface wind speed. •The Microwave imager/sounder is intended to replace the Conical-scanned microwave imager/sounder. However, because the new sensor's capabilities have not yet been fully defined, the impact of the cancellation of the Conical-scanned microwave imager/sounder is not clear. 	5	2

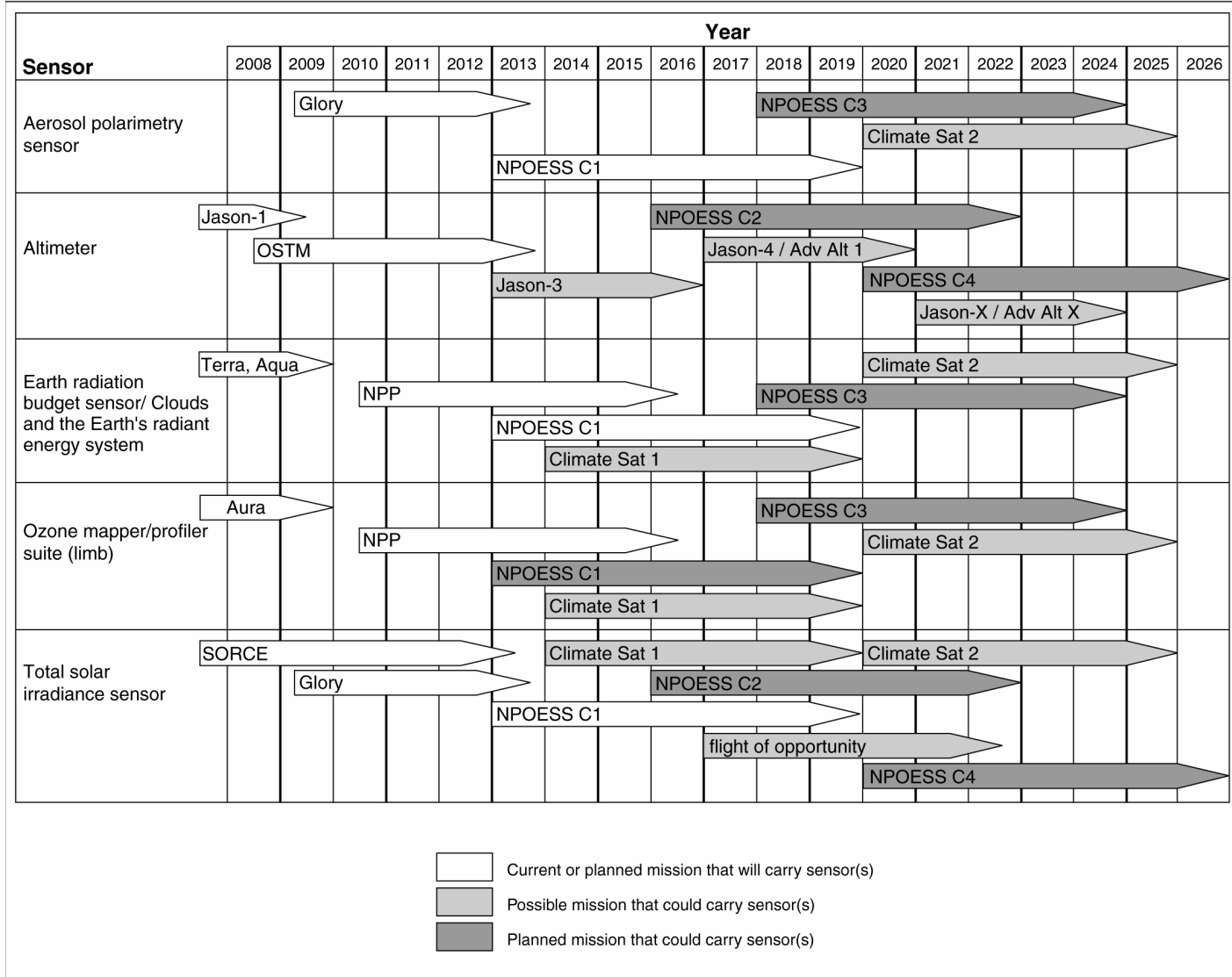
¹⁵ National Research Council, *Options to Ensure the Climate Record from the NPOESS and GOES-R Spacecraft: A Workshop Report* (Washington, D.C.: 2007), and the Office of the Federal Coordinator for Meteorological Services and Supporting Research, *Impacts of NPOESS Nunn-McCurdy Certification and Potential Loss of ACE Spacecraft Solar Wind Data on National Space Environmental Monitoring Capabilities*. (Washington, D.C.: January 2008). The report committee was co-chaired by the director of the Space Weather Prediction Center (NOAA) and the chief of the Integration, Plans, and Requirements division within the U.S. Air Force Directorate for Weather. Agency partners in the Department of Commerce, DOD, NASA, the National Science Foundation, and the Office of the Federal Coordinator for Meteorology concurred with the report.

Sensor/ Description	Likely impact of sensor loss	Climate Working Group's priority for restoration	NPOESS Advisory Group's priority for restoration
Earth radiation budget sensor (being replaced on selected satellites by an existing sensor, the Clouds and the earth's radiant energy system)	<ul style="list-style-type: none"> •Decreased ability to measure the amount of energy entering and leaving the earth •Reduced ability to determine the causes of climate variability and change •Disruption of an over 28-year measurement heritage of earth radiation budget data, which is needed to assess long-term trends. 	2	6
Ozone mapper/profiler suite (limb)	<ul style="list-style-type: none"> •Decreased ability to understand the health of the ozone layer which absorbs solar ultraviolet radiation that is potentially harmful to humans. •Decreased ability to improve global warming and air quality models to differentiate the impact of changing ozone levels within the atmosphere. 	4	4
Space environmental sensor suite (to be replaced on selected satellites by an existing technology sensor, the Space environment monitor)	<ul style="list-style-type: none"> •Decreased understanding of the effect of space weather on military and civilian communications and electrical systems—and ability to take timely mitigation actions. •Decreased situational awareness for missile intercept capabilities •Decreased ability to assess Global Positioning System (GPS) accuracy 	unranked	1
Total solar irradiance sensor	<ul style="list-style-type: none"> •Decreased ability to understand the influence of natural causes of climate change •Disruption of an over 28-year measurement heritage of solar irradiance data, which is needed to assess long-term trends. 	1	5
Radar altimeter	<ul style="list-style-type: none"> •Reduced number of sea surface height and other ocean measurements used in climate monitoring •Decreased ability to measure sea-air interactions that affect regional weather patterns, such as El Niño. •Decreased understanding of storm intensification (e.g., hurricanes), coastal turbulence, and underwater features important to sailors. 	3	3
Survivability sensor	<ul style="list-style-type: none"> •Sensor was to identify possible threats to the NPOESS spacecraft and has no impact on climate observations. 	unranked	8

Source: GAO analysis of NASA, NOAA, DOD, and NRC data.

In addition to prioritizing the sensors, NASA, NOAA, and DOD identified a variety of options for obtaining key sensor data over the next two decades and continue to seek other options. The agencies identified options including adding sensors back to a later NPOESS satellite, adding sensors to another planned satellite, and developing a new satellite to include several of the sensors. Examples of options for several sensors are provided in figure 1. In addition, in December 2007, NOAA released a request for information to determine whether commercial providers could include selected environmental sensors on their satellites.

Figure 1: Selected Options for Restoring Selected Climate Sensors, as of May 2008



Sources: DOD, NASA, and NOAA data.

Notes: (1) The satellites Terra, Aqua, Aura, Glory, and the Solar radiation and climate experiment (SORCE) are all NASA missions. Jason-1 is a joint mission between NASA and France, and the Ocean surface topography mission (OSTM) is a joint mission between NASA, NOAA, France, and the European Organization for the Exploitation of Meteorological Satellites.

(2) The MIS sensor is not included in this chart because NOAA, NASA, and DOD have already agreed to include it on the second, third, and fourth NPOESS satellites. Options for the Space environment sensor suite/ Space environment monitor and the Survivability sensor are not included because DOD has not yet released them.

In addition to prioritizing sensors and identifying options, over the last year, NASA, NOAA, and DOD have taken steps to restore three sensors on a near-term basis. Specifically, in April 2007, the NPOESS Executive Committee decided to restore the limb component of the Ozone mapper/profiler suite to the NPP satellite; in January 2008, to add the Clouds and the earth's radiant energy sensor to NPP; and in May 2008 to add the Total solar irradiance sensor to the first NPOESS satellite. These decisions are expected to provide continuity for these sensors through approximately 2015. Table 7 shows the latest planned configuration of NPOESS satellites. NASA officials noted that they also took steps to mitigate a potential gap in total solar irradiance data by proposing to fund an additional 4 years of the SORCE mission (from 2008 to 2012).

Table 7: Planned Configuration of Instruments on NPP and NPOESS Satellites, as of May 2008 (critical sensors are in bold)

Instrument	NPP	NPOESS C1 (PM)	NPOESS C2 (AM)	NPOESS C3 (PM)	NPOESS C4 (AM)
Advanced technology microwave sounder (unchanged)	X	X	O	X	O
Aerosol polarimetry sensor (canceled)	—	O	—	O	—
Microwave imager/sounder (replacing the canceled Conical-scanned microwave imager/sounder)	—	—	X	X	X
Cross-track infrared sounder (unchanged)	X	X	O	X	O
Data collection system (unchanged)	—	X	X	X	X
Earth radiation budget sensor (canceled, but replaced on NPP and C1 by the Clouds and the earth's radiant energy system sensor)	X	X	—	O	—
Ozone mapper/profiler suite (nadir-unchanged)	X	X	—	X	—
Ozone mapper/profiler suite (limb) (canceled, but added to NPP)	X	O	—	O	—
Radar altimeter (canceled)	—	—	O	—	O
Space environmental sensor suite (canceled)	—	O	O	O	O
Space environment monitor (replacing selected capabilities of the space environmental sensor suite)	—	X	—	X	—
Total solar irradiance sensor (canceled but added to NPOESS C1)	—	X	O	—	O
Survivability sensor (canceled)	—	O	O	O	O
Search and rescue satellite aided tracking system (unchanged)	—	X	X	X	X
Visible/infrared imager radiometer suite (unchanged)	X	X	X	X	X

Source: GAO analysis of program office data.

Key:

X = Sensor is currently planned for this satellite

O = Sensor was canceled but could be restored to this satellite

— = Not applicable—sensor was never planned for this satellite

Agencies Lack Plans to Ensure Long-Term Data Continuity

While NASA, NOAA, and DOD have taken preliminary steps to address the climate and space sensors that were removed from the NPOESS program almost 2 years ago, they do not yet have plans for restoring climate and space environment data on a long-term basis. Specifically, there are as yet no firm plans for obtaining most of this data after 2015. The Office of Science and Technology Policy, an organization within the Executive Office of the President, is currently working with NASA, NOAA, and DOD to sort through the costs and benefits of the various options and to develop plans. However, this effort has been under way for almost 2 years and officials could not estimate when such plans would be completed.

Delays in developing a comprehensive strategy for ensuring climate and space data continuity may result in the loss of selected options. For example, NASA and NOAA estimated that they would need to make a decision on whether to build another satellite to obtain ocean altimeter data in 2008. Also, the NPOESS program office estimated that if any sensors are to be restored to an NPOESS satellite, it would need a decision about 6 years in advance of the planned satellite launch. Specifically, for a sensor to be included on the second NPOESS satellite, the sponsoring agency would need to commit to do so by January 2010.

Without a timely decision on a plan for restoring satellite data on a long-term basis, NASA, NOAA, and DOD risk losing their windows of opportunity on selected options and restoring sensors in an ad hoc manner. Ultimately, the agencies risk a break in the continuity of climate and space environment data. As national and international concerns about climate change and global warming grow, these data are more important than ever to try to understand long-term climate trends and impacts.

GAO Made Recommendations To Ensure That Future Climate Needs are Addressed and to Complete Restructuring Activities

Because of the importance of effectively managing the NPOESS program to ensure that there are no gaps in the continuity of critical weather, environmental, and climate observations, in our accompanying report¹⁶ we made recommendations to the Secretaries of Commerce and Defense and to the Administrator of NASA to establish plans on whether and how to restore the climate and space sensors removed from the NPOESS program by June 2009, in cases where the sensors are warranted and justified. In their comments on the report, all three agencies concurred with our recommendations. In addition, both the Department of Commerce and NASA reiterated that they are working with their partner agencies to finalize plans for restoring sensors.

In addition, we also reemphasized a recommendation made in our prior report that the appropriate NASA, NOAA, and DOD executives immediately finalize key acquisition documents. All three agencies also concurred with this recommendation. Further, Commerce noted that DOD and NASA executives need to weigh in to resolve issues at, or immediately below, their levels in order to ensure prompt completion of the key acquisition documents. NASA noted that difficulties in gaining consensus across all three NPOESS agencies have delayed the signature of key acquisition documents, and reported that they are committed to moving these documents through the signature cycle once all of the issues and concerns are resolved.

In summary, over the past year, program officials have completed major activities associated with restructuring the NPOESS program and have made progress in developing and testing sensors, ground systems, and the NPP spacecraft. However, multiple risks remain. Agency executives have still not signed off on key acquisition

¹⁶ [GAO-08-518](#).

documents that were originally to be completed in September 2006, and now DOD is threatening to withhold funding if the documents are not completed by August 2008—even though DOD has contributed to the delays in completing these documents. Also, one critical sensor has experienced technical problems and schedule delays that have led program officials to delay the NPP launch date by about 8 months. Any delay in the NPP launch date shortens the time available for incorporating lessons learned from NPP onto future NPOESS missions and could also lead to gaps in critical climate and weather data. In addition, risks to the program remain in resolving interagency disagreements on the appropriate level of system security and in revising estimated costs for satellite operations and support. The program office is aware of these risks and is working to mitigate them, but continued problems could affect the program's overall schedule and cost.

When selected climate and space weather sensors were removed from the NPOESS program during its restructuring, NASA, NOAA, and DOD became responsible for determining what environmental data to restore and how to restore them. This responsibility includes justifying the additional funding needed to develop these sensors within their respective agency's investment decision processes. In the 2 years since the restructuring, the agencies have identified their priorities and assessed their options for restoring sensor capabilities. In addition, the agencies made decisions to restore two sensors to the NPP satellite and one to the first NPOESS satellite in order to mitigate near-term data gaps. However, the agencies lack plans for restoring sensor capabilities on a long-term basis. Without a timely decision on a long-term plan for restoring satellite data, the agencies risk a break in the continuity of climate and space environment data. With the increased concern about climate change and global warming, these data are more important than ever to try to understand long-term climate trends and impacts.

Mr. Chairman, this concludes my statement. I would be happy to answer any questions that you or members of the committee may have at this time.

If you have any questions on matters discussed in this testimony, please contact me at (202) 512-9286 or by e-mail at pownerd@gao.gov. Other key contributors to this testimony include Colleen Phillips (Assistant Director), Kate Agatone, and Kathleen S. Lovett.

Appendix I: Status of Key Acquisition Documents

Table 1 identifies the key NPOESS acquisition documents as well as their original and revised due dates. Original due dates were specified in the June 2006 restructuring decision memo. The revised due dates were specified in an addendum to that memo, dated June 2007, and then revised again in another addendum, dated April 2008. Documents that are in bold are overdue.

Table 1: Status of NPOESS Acquisition Documents

Acquisition document	Original due date	Revised due date, as of June 2007	Revised due date, as of April 2008	Status
Alternative Management Plan	June 2007	September 1, 2007	Not applicable	Completed
Award Fee Plan/ Fee Management Plan	Unspecified	October 1, 2007	Due date not revised—remains October 1, 2007	Not completed
Acquisition Program Baseline	September 1, 2006	December 1, 2007	August 31, 2008	Not completed
Acquisition Strategy Report	September 1, 2006	September 1, 2007	August 31, 2008	Not completed
Test and Evaluation Master Plan	September 1, 2006	March 1, 2008	August 31, 2008	Not completed
System Engineering Plan	September 1, 2006	September 1, 2007	Not applicable	Completed
Two-Orbit Plan	November 15, 2006	October 1, 2007	August 31, 2008	Not completed
Human Capital Management Plan (to fill vacancies in the Integrated Program Office)	August 4, 2006	September 1, 2007	Not applicable	Completed
Logistics Support Plan	September 2006	September 1, 2007	Not applicable	Completed
Diminishing Manufacturing Sources/ Parts Obsolescence Plan	September 2006	September 1, 2007	Not applicable	Completed
Tri-agency Memorandum of Agreement	August 4, 2006	September 1, 2007	Due date not revised—remains September 1, 2007	Not completed
Integrated Master Plan	April 2007	September 1, 2007	Not applicable	Completed
Quarterly Integrated Baseline Review	September 2006	September 1, 2007	Not applicable	Completed

Source: GAO analysis of DOD and NPOESS program office data.

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