

October 2007

**GEOSTATIONARY
OPERATIONAL
ENVIRONMENTAL
SATELLITES**

**Progress Has Been
Made, but
Improvements Are
Needed to Effectively
Manage Risks**





Highlights of [GAO-08-18](#), a report to congressional requesters

Why GAO Did This Study

The Department of Commerce’s National Oceanic and Atmospheric Administration (NOAA), with the aid of the National Aeronautics and Space Administration (NASA), plans to procure the next generation of geostationary operational environmental satellites, called the Geostationary Operational Environmental Satellites-R series (GOES-R). This series is considered critical to the United States’ ability to maintain the continuity of data required for weather forecasting through the year 2028.

GAO was asked to (1) assess the status and plans for GOES-R, and (2) evaluate whether NOAA is adequately mitigating key technical and programmatic risks. To do so, GAO analyzed contractor and program data and interviewed officials from NOAA and NASA.

What GAO Recommends

GAO is making recommendations to the Secretary of Commerce to ensure that the GOES-R program effectively manages and mitigates risks. The Secretary agreed with GAO’s recommendations to use a program level risk list and to add selected risks to its list, but disagreed that NOAA has insufficient insight into NASA’s contracts. The Secretary cited an unparalleled transparency between the two agencies. However, NOAA has not demonstrated that it has validated NASA’s contractor performance and GAO remains concerned that NOAA lacks the capability to oversee this key aspect of the program.

To view the full product, including the scope and methodology, click on [GAO-08-18](#). For more information, contact David A. Powner at (202) 512-9286 or pownerd@gao.gov.

GEOSTATIONARY OPERATIONAL ENVIRONMENTAL SATELLITES

Progress Has Been Made, but Improvements Are Needed to Effectively Manage Risks

What GAO Found

NOAA has made progress in planning its GOES-R procurement—which is estimated to cost \$7 billion and scheduled to have the first satellite ready for launch in 2014—but cost and schedules are likely to grow. Specifically, the agency completed preliminary design studies of GOES-R and recently decided to separate the space and ground elements of the program into two separate development contracts. However, this change in the GOES-R acquisition strategy has delayed a decision to proceed with the acquisition. Further, independent estimates are higher than the program’s current cost estimate and convey a low level of confidence in the program’s schedule. Independent studies show that the estimated program could cost about \$2 billion more, and the first satellite launch could be delayed by 2 years. As NOAA works to reconcile the independent estimate with its own program office estimate, costs are likely to grow and schedules are likely to be delayed.

To address cost, schedule, and technical risks, the GOES-R program has established a risk management program and has taken steps to mitigate selected risks. For example, as of July 2007, the program office identified the lack of an integrated master schedule to be its highest priority risk and established plans to bring this risk to closure. However, more remains to be done to fully address GOES-R risks. Specifically, the program has multiple risk watchlists that are not always consistent and key risks are missing from the watchlists, including risks associated with unfilled executive positions, limitations in NOAA’s insight into NASA’s deliverables, and insufficient funds for unexpected costs—called management reserves (see table for more details). As a result, the GOES-R program is at risk that problems will not be identified or mitigated in a timely manner and could lead to program cost overruns and schedule delays.

Description of Key Risks Missing from GOES-R Risk Lists

| Key Risk | Description |
|---|--|
| Unfilled GOES-R executive leadership positions | Two senior GOES-R program positions—the system program director and deputy system program director—are currently filled by NASA and NOAA personnel in an acting capacity until they can be permanently filled by NOAA. The agency reported that it plans to fill the deputy system program director role in the near future, but noted that it could take more than 6 months to fill the system program director role. |
| Limitations in NOAA’s insight into NASA’s deliverables | The established NOAA/NASA interagency agreements do not contain provisions that enable NOAA to ensure that monthly contractor data and reports, submitted by NASA, are reliable and that they accurately depict contractor performance. |
| Insufficient management reserve (for unexpected costs) held by the program and a critical instrument contractor | As of May 2007, the contractor for a critical instrument—the Advanced Baseline Imager—had less than 1 percent of funding in reserve to cover unexpected costs associated with the 40 percent of work left to be completed. In addition, as a result of addressing issues on the Advanced Baseline Imager in March 2007, the reserve funding for the overall GOES-R program dropped below 25 percent—a level that NOAA reported it intended to establish as a lesson learned from other satellite acquisitions. As of July 2007, the reserve level was at about 15 percent. |

Source: GAO analysis.

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Abbreviations

| | |
|--------|---|
| ABI | Advanced Baseline Imager |
| EXIS | Extreme Ultraviolet and X-Ray Irradiance Suite |
| GLM | Geostationary Lightning Mapper |
| GOES-R | Geostationary Operational Environmental Satellites – R Series |
| HES | Hyperspectral Environmental Suite |
| NASA | National Aeronautics and Space Administration |
| NESDIS | National Environmental Satellite Data and Information Service |
| NOAA | National Oceanic and Atmospheric Administration |
| SEISS | Space Environmental In-Situ Suite |
| SIS | Solar Imaging Suite |
| SUVI | Solar Ultra Violet Imager |

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United States Government Accountability Office
Washington, DC 20548

October 23, 2007

The Honorable Nick Lampson
Chairman
The Honorable Bob Inglis
Ranking Member
Subcommittee on Energy and Environment
Committee on Science and Technology
House of Representatives

The Honorable Brad Miller
Chairman
The Honorable James F. Sensenbrenner, Jr.
Ranking Member
Subcommittee on Investigations and Oversight
Committee on Science and Technology
House of Representatives

Operational geostationary environmental satellites play a critical role in our nation's weather forecasting. These satellites—which are managed by the National Oceanic and Atmospheric Administration (NOAA)—provide critical information on atmospheric, oceanic, climatic, and solar conditions that help meteorologists observe and predict global and local weather events. They also provide a means to identify severe storm conditions, such as hurricanes and tornadoes, and to track the movement and intensity of these storms once they develop.

NOAA, with the aid of the National Aeronautics and Space Administration (NASA), is planning to procure the next generation of geostationary satellites, called the Geostationary Operational Environmental Satellites-R series (GOES-R). The GOES-R series is to replace the current series of satellites which will likely begin to reach the end of their useful lives in approximately 2014. This new series is expected to mark the first major technological advance in GOES instrumentation since 1994. It is also considered critical to the United States' ability to maintain the continuity of data required for weather forecasting through the year 2028.

This report responds to your request that we review NOAA's management of the GOES-R program. Specifically, we were asked to (1) assess the status and revised plans for the GOES-R procurement, and (2) evaluate whether NOAA is adequately mitigating key technical and programmatic risks facing the GOES-R program.

To assess GOES-R status and revised plans, we reviewed program documents on the revised acquisition strategy, system requirements, and cost estimates, and interviewed officials from NOAA, NASA, and the contractor for a critical GOES-R instrument. To evaluate whether NOAA is adequately mitigating key technical and programmatic risks, we analyzed risk management plans and also met with internal technical experts to determine the key risks that could negatively affect the program's ability to acquire the GOES-R system. We also interviewed agency officials to evaluate the adequacy of NOAA's mitigation efforts.

We conducted our work at NOAA and NASA offices in the Washington, D.C., metropolitan area and at ITT Corporation in Fort Wayne, Indiana. We performed our work from April 2007 to September 2007, in accordance with generally accepted government auditing standards. Appendix I contains further details on our objectives, scope, and methodology.

Results in Brief

NOAA has made progress on its GOES-R procurement—which is estimated to cost \$7 billion and scheduled to have the first satellite ready for launch in 2014—but costs and schedules are likely to grow. Specifically, NOAA completed preliminary design studies of its GOES-R acquisition and planned to make a decision to proceed to development and production in September 2007. In addition, the agency recently decided to separate the space and ground elements of the program into two separate contracts, to be managed by NASA and NOAA, respectively. However, this change in the GOES-R acquisition strategy has delayed the decision to proceed with the acquisition. Further, independent estimates are higher than the program's current cost estimate and convey a low level of confidence in the program's schedule. Independent studies show that the estimated program could cost about \$2 billion more, and the first satellite launch could be delayed by 2 years. As NOAA works to reconcile the independent estimate with its own program office estimate, costs are likely to grow and schedules are likely to be delayed. In commenting on a draft of this report, NOAA officials stated that while their reconciliation process is still ongoing, the revised cost estimate will likely be \$1 billion more than the current \$7 billion and the first satellite launch will likely be delayed 1 year from 2014, rather than 2 years.

To address cost, schedule, and technical risks, the GOES-R program has established a risk management program and has taken steps to identify and mitigate selected risks. For example, as of July 2007, the program office identified the lack of an integrated master schedule as its highest priority risk. It also identified other risks including technical challenges

affecting the development of a critical instrument and the development of requirements between the space and ground segments. The program has also established plans for bringing these risks to closure. However, more remains to be done to fully address risks. Specifically, the program has multiple risk watchlists that are not always consistent. Further, key risks are missing from the risk lists, including risks associated with unfilled executive positions, limitations in NOAA's insight into NASA's deliverables, and insufficient funds for unexpected costs (called management reserve). As a result, the program is at risk that problems will not be identified or mitigated in a timely manner and could lead to program cost overruns and schedule delays.

We are making recommendations to the Secretary of Commerce to direct the Undersecretary of Commerce for Oceans and Atmosphere to ensure that the GOES-R program office manages, mitigates, and reports on risks using a more comprehensive program-level risk list. In written comments on a draft of this report, the Secretary agreed with our recommendations to use a program level risk list and to add selected risks to its list, but disagreed that NOAA has insufficient insight into NASA's contracts. The Secretary cited an unparalleled transparency between the two agencies. However, NOAA has not demonstrated that it has validated NASA's contractor performance and we remain concerned that NOAA lacks the capability to oversee this important aspect of the program. Given the past problems NOAA had in obtaining insight into NASA's contracts and the importance of this interagency relationship to the success of the GOES-R program, we believe that this issue should be managed and monitored as a risk. The Department also suggested technical comments which we incorporated as appropriate.

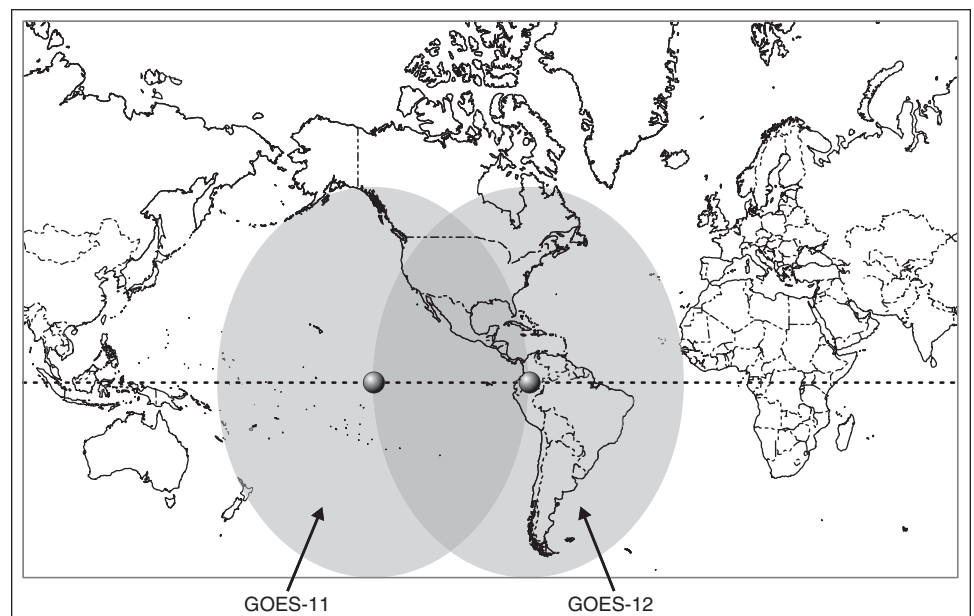
Background

Since the 1960s, geostationary and polar-orbiting environmental satellites have been used by the United States to provide meteorological data for weather observation, research, and forecasting. NOAA's National Environmental Satellite Data and Information Service (NESDIS) is responsible for managing the civilian geostationary and polar-orbiting satellite systems as two separate programs, called GOES and the Polar Operational Environmental Satellites, respectively.

Unlike polar-orbiting satellites, which constantly circle the earth in a relatively low polar orbit, geostationary satellites can maintain a constant view of the earth from a high orbit of about 22,300 miles in space. NOAA operates GOES as a two-satellite system that is primarily focused on the United States (see fig. 1). These satellites are uniquely positioned to

provide timely environmental data to meteorologists and their audiences on the earth's atmosphere, its surface, cloud cover, and the space environment. They also observe the development of hazardous weather, such as hurricanes and severe thunderstorms, and track their movement and intensity to reduce or avoid major losses of property and life. Furthermore, the satellites' ability to provide broad, continuously updated coverage of atmospheric conditions over land and oceans is important to NOAA's weather forecasting operations.

Figure 1: Approximate GOES Geographic Coverage



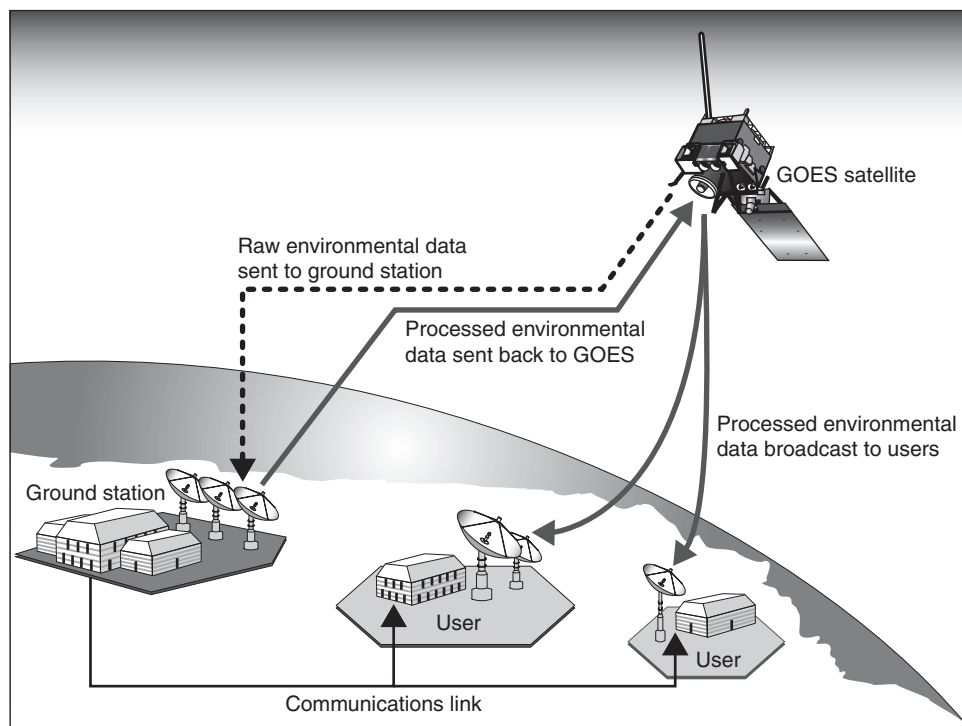
Sources: NOAA (data), MapArt (map).

To provide continuous satellite coverage, NOAA acquires several satellites at a time as part of a series and launches new satellites every few years. Three satellites—GOES-11, GOES-12, and GOES-13—are currently in orbit. Both GOES-11 and GOES-12 are operational satellites, while GOES-13 is in an on-orbit storage mode. It is a backup for the other two satellites should they experience any degradation in service. The others in the series, GOES-O and GOES-P, are planned for launch over the next few years.¹

¹Satellites in a series are identified by letters of the alphabet when they are on the ground and by numbers once they are in orbit.

NOAA is also planning the next generation of satellites, known as the GOES-R series, which are planned for launch beginning in 2014. Each of the operational geostationary satellites continuously transmits raw environmental data to NOAA ground stations. The data are processed at these ground stations and transmitted back to the satellite for broadcast to primary weather services and the global research community here in the United States and abroad. Raw and processed data are also distributed to users via ground stations through other communication channels, such as dedicated private communication lines and the Internet. Figure 2 depicts a generic data relay pattern from the geostationary satellites to the ground stations and commercial terminals.

Figure 2: Generic GOES Data Relay Pattern



Source: GAO analysis of NOAA data.

A Brief History of Prior GOES Series

To date, NOAA has procured three series of GOES satellites and is in the planning stages to acquire a fourth one (see table 1).

Table 1: Summary of the Procurement History of GOES

| Series name | Procurement duration ^a | Satellites |
|----------------------------|-----------------------------------|--------------------------|
| Original GOES ^b | 1970–1987 | 1, 2, 3, 4, 5, 6, 7 |
| GOES I-M | 1985–2001 | 8, 9, 10, 11, 12 |
| GOES-N | 1998–2011 | 13, O, P, Q ^c |
| GOES-R | 2007–2016 | R, S |

Source: GAO analysis of NOAA data.

^aDuration includes time from contract award to final satellite launch.

^bThe procurement of these satellites consisted of four separate contracts for (1) two early prototype satellites and GOES-1, (2) GOES-2 and -3, (3) GOES-4 through -6, and (4) GOES-G (failed on launch) and GOES-7.

^cNOAA decided not to exercise the option for this satellite.

Original GOES Satellites

In 1970, NOAA initiated its original GOES program based on experimental geostationary satellites developed by NASA. While these satellites operated effectively for many years, they had technical limitations. For example, this series of satellites was “spin-stabilized,” meaning that the satellites slowly spun while in orbit to maintain a stable position with respect to the earth. As a result, the satellite viewed the earth only about 5 percent of the time and had to collect data very slowly, capturing one narrow band of data each time its field of view swung past the earth. A complete set of sounding data² for GOES-4 through GOES-7 took 2 to 3 hours to collect.

GOES I-M Series

In 1985, NOAA and NASA began to procure a new generation of GOES, called the GOES I-M series, based on a set of requirements developed by NOAA’s National Weather Service, NESDIS, and NASA, among others. GOES I-M consisted of five satellites, GOES-8 through GOES-12, and was a significant improvement in technology from the original satellites. For example, GOES I-M was “body-stabilized,” meaning that the satellite held a fixed position in orbit relative to the earth, thereby allowing for continuous meteorological observations. Instead of maintaining stability by spinning, the satellite would preserve its fixed position by continuously making small adjustments in the rotation of internal momentum wheels or by firing small thrusters to compensate for drift. This and other enhancements meant that the GOES I-M satellites would be able to collect

²Sounding data is information on the vertical structure of temperature and water vapor.

significantly better quality data more quickly than the older series of satellites.

GOES-N Series

In 1998, NOAA began the procurement of satellites to follow GOES I-M, called the GOES-N series. This series used existing technologies for the instruments and added system upgrades, including an improved power subsystem and enhanced satellite pointing accuracy. Furthermore, these satellites were designed to operate longer than their predecessors. This series originally consisted of four satellites—GOES-N through GOES-Q. However, the option for the GOES-Q satellite was cancelled based on NOAA’s assessment that it would not need the final satellite to continue weather coverage. In particular, the agency found that the satellites already in operation were lasting longer than expected and that the first satellite in the next series could be available to back up the last of the GOES-N satellites. As noted earlier, the first GOES-N series satellite—GOES-13—was launched in May 2006. The GOES-O and GOES-P satellites are currently in production and are expected to be launched in July 2008 and July 2011, respectively.

Planned GOES-R Series

NOAA is currently planning to procure the next series of GOES satellites—called the GOES-R series—which is intended to provide the first major technological advance in instrumentation since the launch of the first satellite of the GOES I-M series in 1994.³ The original plans for this series included four satellites—GOES-R through GOES-U. However, in September 2006, NOAA reduced the scope of the program to consist of a minimum of two satellites and removed a technically complex instrument because it was estimated that program costs could almost double the original cost estimate.

GOES-R Program—An Overview

NOAA plans for the GOES-R program to improve on the technology of prior series, in terms of both system and instrument improvements. The system improvements are expected to fulfill more demanding user requirements and to provide more rapid information updates. Table 2 highlights key system-related improvements GOES-R is expected to make to the geostationary satellite program.

³The instruments were based on 1980s technology.

Table 2: Summary of Key GOES-R System Improvements

| Key feature | GOES-N (current) | GOES-R |
|--|------------------|---------|
| Total number of products | 41 | ~68-120 |
| Downlink rate of raw data collected by instruments (from satellite to ground stations) | 2.6 Mbps | 70 Mbps |
| Broadcast rate of processed GOES data (from satellite to users) | 2.1 Mbps | 40 Mbps |
| Raw data storage (the length of time that raw data will be stored at ground stations) | 0 days | 3 days |

Source: GAO analysis of NOAA data.

In addition to the system improvements, the instruments on the GOES-R series are expected to significantly increase the clarity and precision of the observed environmental data. NOAA originally planned to acquire six different types of instruments. Furthermore, two of these instruments—the Advanced Baseline Imager and the Hyperspectral Environmental Suite—were considered to be the most critical because they would provide data for key weather products. Table 3 summarizes the originally planned instruments and their expected capabilities.

Table 3: Originally Planned GOES-R Series Instruments, as of August 2006

| Planned instrument | Description |
|--|---|
| Advanced Baseline Imager (ABI) | Expected to provide variable area imagery and radiometric information of the earth's surface, atmosphere, and cloud cover. Key features include <ul style="list-style-type: none">• monitoring and tracking severe weather,• providing images of clouds to support forecasts, and• providing higher resolution, faster coverage, and broader coverage simultaneously. |
| Hyperspectral Environmental Suite (HES) ^a | Expected to provide information about the earth's surface to aid in the prediction of weather and climate monitoring. Key features include <ul style="list-style-type: none">• providing atmospheric moisture and temperature profiles to support forecasts and climate monitoring,• monitoring coastal regions for ecosystem health, water quality, coastal erosion, and harmful algal blooms, and• providing higher resolution and faster coverage. |
| Geostationary Lightning Mapper (GLM) | Expected to continuously monitor lightning activity over the United States and provide a more complete dataset than previously possible. Key features include <ul style="list-style-type: none">• detecting lightning strikes as an indicator of severe storms and• providing a new capability to GOES that only previously existed on polar satellites. |
| Magnetometer | Expected to provide information on the general level of geomagnetic activity, monitor current systems in space, and permit detection of magnetopause crossings, sudden storm commencements, and substorms. |

| Planned instrument | Description |
|---|--|
| Space Environmental In-Situ Suite (SEISS) | <p>Expected to provide information on space weather to aid in the prediction of particle precipitation, which causes disturbance and disruption of radio communications and navigation systems. Key features include</p> <ul style="list-style-type: none"> • measuring magnetic fields and charged particles, • providing improved heavy ion detection, adding low energy electrons and protons, and • enabling early warnings for satellite and power grid operation, telecom services, astronauts, and airlines. |
| Solar Imaging Suite (SIS) ^b | <p>Expected to provide coverage of the entire dynamic range of solar X-ray features, from coronal holes to X-class flares, as well as estimate the measure of temperature and emissions. Key features include</p> <ul style="list-style-type: none"> • providing images of the sun and measuring solar output to monitor solar storms and • providing improved imager capability. |

Source: GAO analysis of NOAA data.

^aHES was cancelled in September 2006.

^bSIS development work was divided into two separate acquisitions, the Solar Ultra Violet Imager (SUVI) and the Extreme Ultraviolet and X-Ray Irradiance Suite (EXIS).

More recently, however, NOAA reduced the scope of the GOES-R program because of expectations of higher costs. In May 2006, the program office projected that total costs, which were originally estimated to be \$6.2 billion, could reach \$11.4 billion. We reported that this led NOAA to reduce the scope and technical complexity of the baseline program.⁴ Specifically, in September 2006, NOAA reduced the minimum number of satellites from four to two, cancelled plans for developing the Hyperspectral Environmental Suite, and estimated the revised program would cost \$7 billion. Table 4 provides a summary of the timeline and scope of these key changes.

⁴GAO, *Geostationary Operational Environmental Satellites: Additional Action Needed to Incorporate Lessons Learned from Other Satellite Programs*, [GAO-06-1129T](#) (Washington, D.C.: Sept. 29, 2006) and *Geostationary Operational Environmental Satellites: Steps Remain in Incorporating Lessons Learned from Other Satellite Programs*, [GAO-06-993](#) (Washington, D.C.: Sept. 6, 2006).

Table 4: Key Changes to the GOES-R Program

| | Baseline program, as of August 2006 | Program with reduced scope, as of September 2006 |
|---|--|--|
| Number of satellites | 4 | 2 |
| Planned instruments | 2 critical instruments and 4 noncritical instruments or instrument suites | 1 critical instrument and 4 noncritical instruments or instrument suites |
| | Critical instruments: <ul style="list-style-type: none"> • Advanced Baseline Imager • Hyperspectral Environmental Suite | Critical instrument: <ul style="list-style-type: none"> • Advanced Baseline Imager |
| | Noncritical instruments/suites: <ul style="list-style-type: none"> • Geostationary Lightning Mapper • Magnetometer • Space Environmental In-Situ Suite • Solar Imaging Suite | Noncritical instruments/suites: <ul style="list-style-type: none"> • Geostationary Lightning Mapper • Magnetometer • Space Environmental In-Situ Suite • Two components of the former Solar Imaging Suite (the Solar Ultra Violet Imager and Extreme Ultraviolet and X-Ray Irradiance Suite) |
| Life-cycle cost estimate (in then year dollars) | \$6.2 – 11.4 billion | \$7 billion |
| End of operations and maintenance | 2028 | 2028 ^a |

Source: GAO analysis of NOAA data.

^aAll satellites are expected to have a 15-year lifespan (5 years in on-orbit storage plus 10 years in operation).

In our September 2006 report, we made a number of recommendations to improve the agency’s ability to effectively manage GOES-R based on lessons learned from other satellite procurements. In particular, we recommended that NOAA establish a process for objectively evaluating and reconciling government and independent cost estimates once the scope of the program was finalized. We also recommended that the agency perform a comprehensive review of the Advanced Baseline Imager to

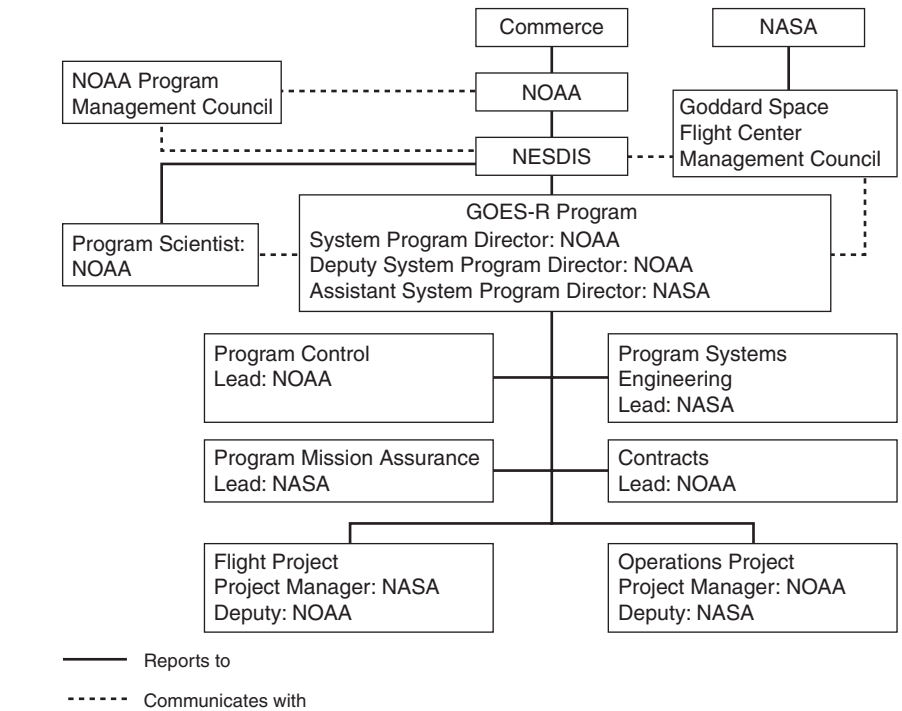
determine the level of technical maturity achieved prior to moving the instrument into production and to seek assistance in determining the appropriate levels of resources needed at the program office to adequately track and oversee the contractor's earned value management data.⁵ The agency agreed with our recommendations and has completed a comprehensive review of the Advanced Baseline Imager. Actions on other recommendations are under way. For example, NOAA has established a team to conduct a line-by-line reconciliation of the government and independent cost estimates. Additionally, NOAA plans to have four earned value specialists on staff by the end of 2007 and has requested that NASA determine the appropriate level of resources needed to perform its earned value management functions.

GOES-R Program Office Structure

NOAA is solely responsible for GOES-R program funding and overall mission success. However, since it relies on NASA's acquisition experience and technical expertise to help ensure the success of its programs, NOAA implemented an integrated program management structure with NASA for the GOES-R program (see fig. 3). Within the program office, there are two project offices that manage key components of the GOES-R system. These are called the flight and operations project offices. The flight project office oversees the spacecraft, instruments, and launch services. The operations project office oversees the ground elements and on-orbit operations of the satellites. The project manager for the flight project office and the deputy project manager for operations project office are designated to be filled with NASA personnel. Additionally, NOAA has located the program office at NASA's Goddard Space Flight Center.

⁵Earned value management is a method that compares the value of work accomplished during a given period with that of the work expected in that period.

Figure 3: GOES-R Program Office Structure and Staffing



Source: NOAA.

Planned GOES-R Acquisition Strategy

NOAA’s acquisition strategy was to award contracts for the preliminary design of the GOES-R system to several vendors who would subsequently compete for the contract to be the single prime contractor responsible for overall system development and production. As such, in October 2005, NOAA awarded contracts for the preliminary design of the overall GOES-R system to three vendors.⁶

In addition, to reduce the risks associated with developing technically advanced instruments, NASA awarded contracts for the preliminary designs for five of the originally planned instruments. NASA expected to subsequently award development contracts for these instruments and to

⁶These were called Program Definition and Risk Reduction contracts.

eventually turn them over to the prime contractor responsible for the overall GOES-R program.

GOES-R Preliminary Design Studies Are Completed, but Key Program Changes Have Been Made and Cost and Schedule Estimates Are Likely to Grow

NOAA has completed preliminary design studies of its GOES-R procurement. In addition, the agency recently decided to separate the space and ground elements of the program into two separate contracts to be managed by NASA and NOAA, respectively. However, this change has delayed a key decision to proceed with the acquisition, which was planned for September 2007. Further, independent estimates are higher than the program's current \$7 billion cost estimate and convey a low level of confidence in the program's schedule for launching the first satellite by 2014. As NOAA works to reconcile the independent estimate with its own program office estimate, costs are likely to grow and schedules are likely to be delayed.

Progress Has Been Made on GOES-R Procurement Activities

NOAA and NASA have made progress on GOES-R. The program office has completed preliminary design studies of the overall GOES-R system and has initiated development work on most of the planned instruments. Specifically, the NOAA-issued contracts for the preliminary design of the overall GOES-R system to three vendors have ended, and the designs have been completed.

In addition, after completing preliminary designs on five of the originally planned instruments, NASA awarded development contracts for three of them.⁷ Further, the most critical of these instruments—the Advanced Baseline Imager—has completed a major development milestone. In February 2007, it passed a critical design review gate and NASA approved the contractor to begin production of a prototype model. See table 5 for the summary of the contracts on GOES-R and its component instruments.

⁷NASA has not yet issued a development contract for the Geostationary Lightning Mapper. This contract is expected to be awarded at the end of October 2007.

Table 5: Status of GOES-R and Component Contracts, as of July 2007

| GOES-R component | Contract scope | Contractor | Status |
|---|----------------------------|--|---------------------------|
| Overall program | preliminary design | Boeing, Lockheed Martin, Northrop Grumman | completed |
| | development and production | to be determined | contract award is pending |
| ABI instrument | preliminary design | Ball, ITT Corp., Raytheon | completed |
| | development and production | ITT Corp. | under way |
| HES instrument | preliminary design | BAE Systems, Ball, ITT Corp. | completed |
| | development and production | | cancelled |
| SEISS instrument | preliminary design | Assurance Technology Corp., Lockheed Martin | completed |
| | development and production | Assurance Technology Corp. | under way |
| SIS instruments (consisting of SUVI and EXIS) | preliminary design | Lockheed Martin | completed |
| | development and production | SUVI: Lockheed Martin | under way |
| | | EXIS: Laboratory for Atmospheric and Space Physics | under way |
| GLM instrument | preliminary design | Ball, ITT Corp., Lockheed Martin | completed |
| | development and production | to be determined | contract award is pending |

Source: GAO analysis of NOAA and NASA data.

NOAA Revised its Acquisition Strategy

NOAA recently made a number of key changes in how it plans to acquire the GOES-R system. Originally, NOAA planned to award and manage a single prime contract for the acquisition and operation of the integrated system. However, an independent review team assessed the program and

found that this approach was risky.⁸ It recommended that NOAA split the acquisition effort into two separate contracts for the space and ground segments and have NASA manage the space segment. The independent review team concluded that there was less risk in continuing with this approach than there would be if NOAA took on a new and expanded role.

In March 2007, Commerce approved NOAA's decision to implement these recommendations. The agency revised its acquisition strategy to include two separate contracts—the space segment and the ground segment. The two contracts are expected to be awarded in May 2008 and August 2008, respectively. The space segment is to be managed by a NASA-led flight project office. As such, NASA is to be responsible for awarding and managing the space segment contract, delivering the flight-ready instruments to the space segment contractor for integration onto the satellites, and overseeing the systems engineering and integration. NOAA is to be responsible for the ground segment contract, which is to be managed by the NOAA-led operations project office.

The revised acquisition strategy has delayed NOAA's plans to complete a key decision milestone on whether to proceed with GOES-R development and production in September 2007. Once this decision is made, the final requests for proposals on the system segments are to be released. The agency could not provide a timeframe for when this key decision milestone would take place.

GOES-R Cost Estimates Are Likely to Grow and Schedule Estimates Are Likely to Slip

NOAA's current estimate that the life cycle cost of the GOES-R program would be \$7 billion is likely to grow, and its estimate that the first satellite would be launched in December 2014 is likely to slip. Consistent with best practices in cost estimating, in May 2007, NOAA had two different cost estimates completed for the current GOES-R program—one by its program office and one by an independent cost estimating firm. The program office estimated with 80 percent confidence that the program would cost \$6.9 billion. The independent estimating firm estimated with 80 percent confidence that the program would cost \$9.3 billion.

⁸This independent review team, comprised of former senior industry and government space acquisition experts, was hired by NOAA to assess the adequacy of the GOES-R program's management approach, acquisition strategy, and resource availability, among other things.

A comparison of the two cost models shows that the independent estimator has about a 20 percent level of confidence that the program can be completed for \$6.9 billion. Further, the independent estimator concluded that the program office estimate significantly understated the risk of cost overruns. Other major differences between the two estimates are contained in government costs and in the space and ground segments. In commenting on a draft of this report, NOAA officials noted that one of the differences between the estimates is the inflation rate. The independent estimator assumed a higher inflation rate than the rate that NOAA and NASA typically use. NOAA officials noted that if the independent estimate was adjusted to NOAA's inflation rate, the program's cost estimate with 80 percent confidence would be \$8.7 billion. However, we believe that the value of an independent estimate is that it does not necessarily use the same assumptions as the program office. By offering alternative assumptions, the independent estimate provides valuable information for government officials to consider when revising program cost estimates.

Program officials are reconciling the two different cost estimates and plan to establish a new program cost estimate to be released in conjunction with the President's fiscal year 2009 budget in February 2008. Program officials were unable to provide us information on the reconciled estimate until it is released. Nonetheless, the revised cost estimate will likely be \$1 billion more than the current \$7 billion.

Regarding schedule, NOAA's current plan to launch the first GOES-R series satellite in December 2014 could be delayed. This schedule was driven by a requirement that the satellites be available to back up the last remaining GOES satellites (GOES-O and GOES-P) should anything go wrong during the planned launches of these satellites (see table 6). However, as part of its cost estimate, the independent estimator performed a schedule risk analysis. The independent estimator determined that there was less than a 50 percent chance that the first satellite would be ready for launch by December 2014 and that a later date would be more realistic. The estimator determined that it had 50 percent confidence that the first satellite would launch by October 2015 and 80 percent confidence that the satellite would launch by March 2017. A delay of this magnitude could affect the continuity of GOES data should the agency experience problems with the predecessor satellites.

Table 6: GOES-R Program Launch Schedule, as of July 2007

| Milestone | Planned date |
|---------------------------------------|---------------------|
| GOES-O launch ^a | April 2008 |
| GOES-P launch ^a | April 2009 |
| GOES-R satellite available for launch | Dec. 2014 |
| GOES-S satellite available for launch | April 2016 |

Source: NOAA.

^aGOES-O and GOES-P are not part of the GOES-R series program. Their launch dates are provided because of their relevance to the GOES-R series satellite schedules.

NOAA is Taking Steps to Address Key Risks, but More Remains to Be Done

To address cost, schedule, and technical risks, the GOES-R program established a risk management program and has taken steps to identify and mitigate selected risks. However, more remains to be done to fully address a comprehensive set of risks. Specifically, the program has multiple risk watchlists and they are not always consistent. Further, key risks are missing from the risk lists, including risks associated with unfilled executive positions, limitations in NOAA's insight into NASA's deliverables, and insufficient funding for unexpected costs (called management reserve) on a critical sensor. As a result, the GOES-R program is at increased risk that problems will not be identified or mitigated in a timely manner and that they could lead to program cost overruns and schedule delays.

GOES-R Has a Risk Management Program and Is Taking Measures to Address Selected Risks

The GOES-R program office established a risk management program and is tracking and mitigating selected risks. Risk management is a leading management practice that is widely recognized as a key component of a sound system development approach. An effective risk management approach typically includes identifying, prioritizing, and mitigating risks, and escalating key risks to the attention of senior management.

In accordance with leading management practices, the GOES-R program identifies risks, assigns a severity rating to risks, tracks these risks in a database, plans response strategies for each risk in the database, and reviews and evaluates these risks during monthly program risk management board meetings. Programwide and project-specific risks are managed by different offices. The program office identifies and tracks programwide risks—those that affect the overall GOES-R program.

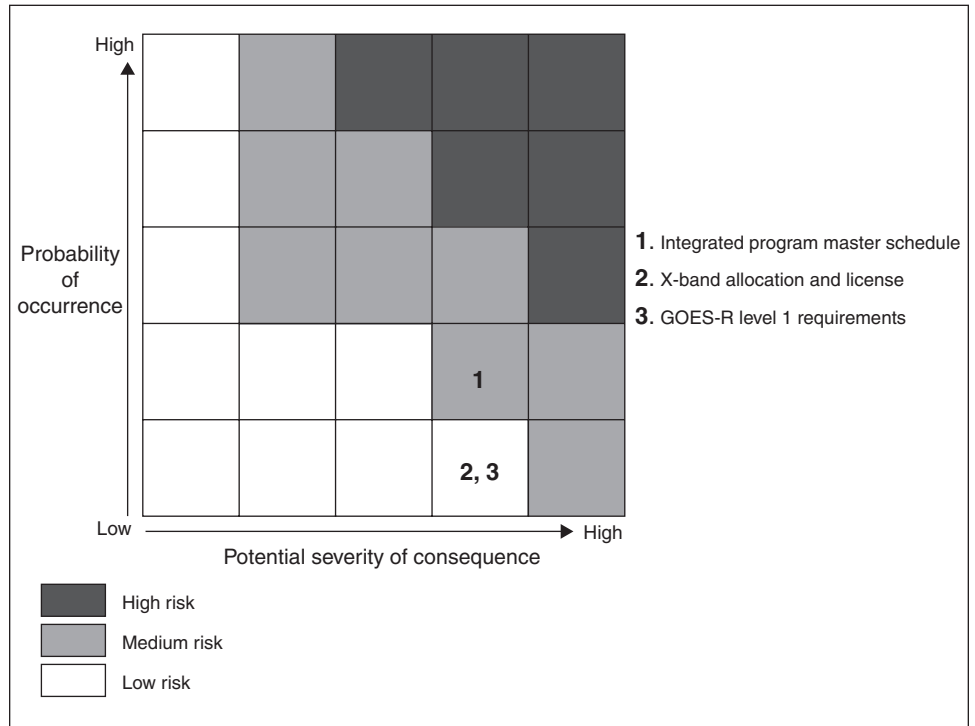
GOES-R Program Office
Identified and Is Working to
Mitigate Programwide Risks

NASA's flight project office and NOAA's operations project office manage risks affecting their respective aspects of the program.⁹ Further, the program office briefs senior executives on top program and project risks on a monthly basis.

As of July 2007, the program office identified three program risks affecting the overall GOES-R program (see fig. 4). These risks include the development of the integrated master schedule, the ability to secure authorization to use a key frequency band to meet the space-to-ground communication data link requirements for the GOES-R system, and the final approval of the GOES-R mission requirements from the NOAA Deputy Undersecretary.

⁹NASA's GOES-R flight project office is responsible for the spacecraft, instruments, and launch services. NOAA's GOES-R operations project office is responsible for the ground elements and on-orbit operations of the satellites.

Figure 4: Top Program Risks as Identified by the GOES-R Program Office, as of July 2007



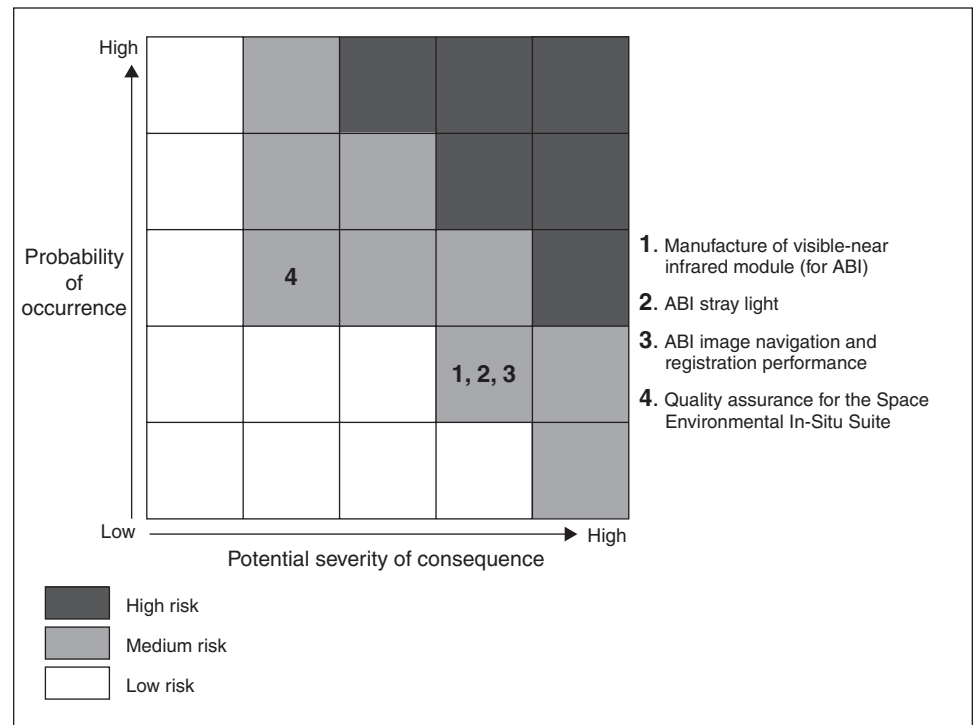
Source: NOAA.

NOAA is working to mitigate and close program risks that it is tracking. For example, the program office recently closed the risk associated with GOES-R requirements because it had sufficiently defined and obtained approval of these requirements. As another example, the program office considers the lack of an integrated master schedule to be its highest priority risk. Program officials reported that completion of the integrated master schedule is driven by the completion of the intermediate schedules for the ground segment and the space-to-ground interdependencies. Key program staff members, including a resident scheduler, meet on a weekly basis to resolve outstanding design issues and hone these schedules. Program officials reported that the intermediate schedules are near completion and that they plan to have the integrated master schedule completed in Fall 2007. They expect to remove this issue from the risk watchlist at that time.

NASA Identified Flight Segment Risks and Is Working to Mitigate Them

As of July 2007, the NASA flight project office identified four risks affecting instrument development, all of which are classified as medium risk (see fig. 5). The top three risks pertain to the advanced imaging instrument, ABI—including issues on timely and quality subcontractor delivery of a critical part, stray light negatively impacting the performance of the optical system, and meeting specified performance requirements on image navigation and registration. The fourth priority risk pertains to the improvement of subcontractor quality assurance on a key sensor for the Space Environmental In-Situ Suite.

Figure 5: Risks Identified by the GOES-R Flight Project Office, as of July 2007



Source: NOAA.

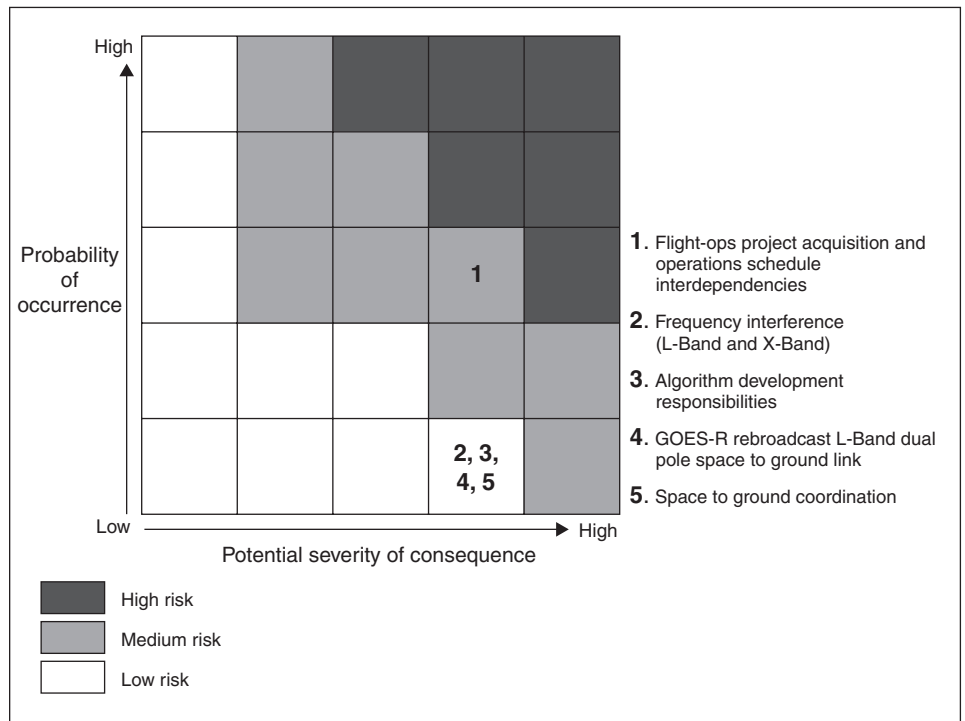
NASA is working to mitigate the flight segment risks that it is tracking. For example, the ABI contractor, among other things, plans to complete a key simulation review before the end of the year (called the structural thermal optical performance analysis) to evaluate whether the instrument can meet its expected performance parameters for image navigation and registration. NASA also recently conducted a vendor facility assessment of the SEISS subcontractor to determine whether adequate quality assurance

NOAA Identified Risks in its Operations Segment and Is Working to Mitigate Them

improvements had been made to be compliant with contract requirements. These actions are expected to help mitigate the risk.

As of July 2007, the NOAA operations project office identified five risks impacting the management and development of the ground system and operations, including one that is identified as a medium risk (see fig. 6). These risks include, among other things, inadequate definition of flight and operations project interdependencies, algorithm development responsibilities, and the adequate definition of coordination requirements between the space and ground segments to ensure that the two requests for proposals are consistent.

Figure 6: Risks Identified by the GOES-R Operations Project Office, as of July 2007



Source: NOAA.

NOAA is working to mitigate the ground system and operations risks that it is tracking. For example, for the highest priority risk regarding schedule interdependencies, key staff from both the flight and operations projects meet weekly in order to identify and synchronize project schedules. The project office expects to close this risk in Fall 2007.

Multiple Watchlists Are Not Consistent, Making it Difficult to Prioritize and Manage Risks

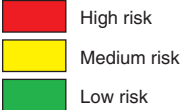
While GOES-R has implemented a risk management process, its multiple risk watchlists are not consistent in areas where there are interdependencies between the lists, which makes it difficult to effectively prioritize and manage risks at the appropriate organizational levels. Sound risk management practices call for having a consistent prioritization approach and for significant problems to be elevated from the component level to the program level. This is because an issue affecting a critical component could have severe programmatic implications and should be identified, tracked, and overseen at the program level. In addition, program executives should be briefed regularly on the status of key risks.

However, on the GOES-R program, the risks identified on the multiple risk lists are inconsistent in areas where there are interdependencies between the lists. These interdependencies include situations where a risk is raised by one project office and affects the other project office, but is not identified by the other project office or elevated to the program level risk list. They also include situations where a risk identified by a project office has programwide implications, but is not elevated to the program level risk list. For example, the operations project office identified schedule interdependencies between the flight and operations project offices as a medium criticality risk, but neither the flight project office nor the program identified this risk even though it is relevant to both. As another example, the operations project office identified the ground procurement schedule as a major issue in its briefing to senior management, but this risk was not identified on its own or on the programwide risk lists.

In addition, while the three offices brief senior management about their key risks on a monthly basis, selected risks may not be accurately depicted in these briefings because of the inconsistencies among the risk watchlists. For example, both the flight and operations project offices identified technical development issues as minor to moderate risk areas, but the program office did not identify this item as a risk and, when it briefed senior management, it noted that technical development was in good shape. Figure 7 depicts examples of inconsistencies among risk lists and briefings to senior management.

The lack of consistency in managing risks in areas where there are interdependencies makes it difficult to ensure that all identified risks are appropriately prioritized and managed. This situation hampers the program office's ability to identify and mitigate risks early on and to anticipate and manage the impact of risks on other areas of the program.

Figure 7: Examples of Inconsistencies among GOES-R Risk Watchlists, as of July 2007

| | Risk: Schedule interdependencies between the flight and operations segments | Risk: Ground procurement schedule | Risk: Technical development issues | |
|---|--|--|--|---|
| Program Office's risk list | not identified as a risk | not identified as a risk | not identified as a risk | |
| Flight Project Office's risk list | not identified as a risk | not applicable—is an operations project office issue | 3 technical risks listed as medium criticality | |
| Operations Project Office's risk list | listed as medium criticality | not identified as a risk | 1 technical risk listed as low criticality | |
| Briefing to senior executive council | not identified as a risk | identified as having major issues | Program Office identified risk area as in good shape | <ul style="list-style-type: none"> • Flight Project identified risk area as having moderate issues • Operations Project identified risk area as having minor issues |
|  | | | | |

Source: GAO analysis of NASA and NOAA data.

Important GOES-R Management Risks Are Missing from the Program Watchlist

To be effective, a risk management program should have a comprehensive list of risks. However, several key risks that impact the GOES-R procurement and merit agency attention are not identified in the program's risk lists. These risks include (1) key leadership positions that need to be filled, (2) NOAA's limited insight into NASA's deliverables, and (3) insufficient management reserves (held by the program and a key instrument contractor). At the conclusion of our review, program officials stated that they are aware of these issues and working to monitor them or address them, as warranted. Nevertheless, until these and other programwide risks are identified and addressed as part of a comprehensive risk management program, there is increased likelihood that issues will be overlooked that could affect the acquisition of the GOES-R system.

Key GOES-R Leadership Positions Need to be Filled

The two senior GOES-R program positions—the system program director and deputy system program director—are currently filled by NASA and NOAA personnel in an acting capacity until they can be permanently filled by NOAA. In addition, the acting system program director is not able to

NOAA's Insight into NASA's
Program Elements Is Limited

work full time in this role because she is also on a special assignment as the NESDIS Deputy Assistant Administrator for Systems. NOAA reported that it plans to fill the deputy system program director role in the near future, but noted that it could take more than 6 months to fill the system program director role. Given the approach of the development phase of the GOES-R acquisition and the competing priorities of the acting system program director, it is especially important that these key leadership positions be filled quickly. At the conclusion of our review, agency officials stated that they are aware of this issue and working to fill the positions, but they did not believe the issue warranted inclusion on the program level risk watch list. However, without the senior level attention inherent in a sound risk management program, it is not clear that NOAA is sufficiently focused on the importance of establishing knowledgeable and committed program executives, or in moving quickly to fill these critical positions.

NOAA's March 2007 decision to adopt an acquisition management approach similar to prior GOES procurements could make the agency vulnerable to repeating some of the problems experienced in the past. In particular, our work on the GOES I-M series found that NOAA did not have the ability to make quick decisions on problems because portions of the procurement were managed by NASA.¹⁰ In fact, NOAA officials originally intended to depart from this approach as a lesson they learned from the GOES I-M acquisition, because it limited the agency's insight and management involvement in the procurement of major elements of the system.

The established NOAA/NASA interagency agreements require NASA to submit monthly contractor cost performance reports to NOAA and to alert NOAA should cost and schedule performance drop below certain thresholds. NASA is currently submitting the required reports and has alerted NOAA on major cost and schedule changes. However, these interagency agreements do not contain provisions that enable NOAA to ensure that the data and reports are reliable and that they accurately depict contractor performance. To do so would entail NOAA having the ability and means to question and validate data, such as by having direct access to the contractor.

¹⁰[GAO-06-993](#).

Recent Changes on a Key Instrument Have Reduced Program Management Reserve Funds and Limited Contractor Reserve Funds Leave GOES-R Vulnerable to Future Cost Increases

NASA and NOAA officials reported that the two agencies are working together with an unparalleled level of transparency and noted that NOAA program staff have access to contractor data and can bring any questions with the data to the relevant NASA staff. However, they acknowledged that this process is not documented and were not able to demonstrate that NOAA staff had questioned contract data and that NASA had facilitated obtaining answers to the questions. By not identifying and mitigating this risk on its program risk list, NOAA increases the likelihood that the GOES-R program will repeat the management and contractor shortfalls that plagued past GOES procurements.

A recent modification to the critical ABI instrument contract increased its cost, thereby reducing the amount of management reserve funds held by the program office for unexpected expenses. In September 2006, we reported that ABI was experiencing technical challenges, resulting in cost and schedule overruns. Since then, the contractor continued missing cost and schedule targets—a trend that continued until February 2007. At that time, NASA modified the contract to implement a revised baseline cost and schedule. The added cost of this modification was funded using management reserve funds held by the GOES-R program office.¹¹ As a result, the amount of reserve held by the program office dropped below 25 percent—a level that NOAA reported it intended to establish as a lesson learned from other satellite acquisitions. As of July 2007, the program’s reserve level was at about 15 percent. Program officials stated that their revised goal is to maintain between 10 and 15 percent in reserve at the program level. While maintaining a 10 to 15 percent management reserve is on par with other major satellite acquisitions, the depletion of management reserves this early in the GOES-R acquisition raises concerns that there will be insufficient reserves during the challenging development, integration, and testing phases to come.

In addition, the contractor for the ABI instrument has a very low level of reserve funding for unexpected costs, which means that any unexpected problems will likely lead to cost growth on the overall GOES-R program. As of May 2007, the contractor was holding less than 1 percent of funding in reserve to cover unexpected costs associated with the 40 percent of work left to be completed. As such, there is a risk that the new baseline could fail due to inadequate reserves to finish the program. This would

¹¹This reserve is intended to cover expected costs above those projected by the contractor and unexpected costs in solving problems during a system development program.

likely have a diminishing effect on the reserve held by the GOES-R flight project and the program office to cover the costs of a second revised baseline plan. Our prior work on system acquisitions has shown inadequate reserves to be an indicator of poor management performance that could lead to cost overruns.¹² Considering that GOES-R has not yet entered the development and production phase, it will be critical for NOAA's senior executive management to aggressively manage this risk. By not identifying, mitigating, and tracking this risk in a programwide risk list, the GOES-R program runs an increased risk that unanticipated issues on the ABI instrument will lead to programwide cost overruns and schedule delays.

Conclusions

Over the last year, NOAA has completed preliminary design studies of its GOES-R system and has made a number of key changes to the program. Current program plans call for a two-satellite program—estimated to cost about \$7 billion—with launch of the first satellite in December 2014. However, independent studies show that the program's cost could increase by about \$2 billion more and the first launch could be delayed by at least 2 years.

NOAA has taken steps to identify and address key risks but more could be done to effectively manage risks from a programwide perspective. In particular, the program has multiple risk watchlists that are not consistent in areas where there are interdependencies and key risks have not been elevated for programwide attention. Also, several risks that warrant NOAA's attention have not been placed on any watchlist. Specifically, the top two leadership positions are only temporarily filled; NOAA does not have the ability and means to obtain insight into NASA contracts in order to validate contractor performance data; and insufficient management reserves to handle unexpected problems on a critical instrument and at the program level are likely to affect overall program costs when any unexpected problems arise. Until NOAA manages and addresses a comprehensive set of program risks, the agency's ability to effectively manage the GOES-R acquisition will be significantly weakened and could lead to substantial program overruns and delays.

¹²[GAO-06-993](#).

Recommendations for Executive Action

To improve NOAA's ability to effectively manage the procurement of the GOES-R system, we recommend that the Secretary of Commerce direct the Undersecretary of Commerce for Oceans and Atmosphere to take the following two actions:

- Ensure that the GOES-R program office manages, mitigates, and reports on risks using a program-level risk list that is reconciled with and includes risks from its flight and operations project offices that could impact the overall program.
- Include the following risks on the programwide risk list, develop plans to mitigate them, and report to senior executives on progress in mitigating them:
 - unfilled or temporary GOES-R program leadership positions,
 - insufficient program insight on NASA contract performance, and
 - insufficient management reserve on the critical Advanced Baseline Imager instrument and at the GOES-R program level.

Agency Comments and Our Evaluation

The Department of Commerce provided written comments on a draft of this report (see app. II). In the department's response, the Secretary of Commerce agreed with our recommendations to use a program level risk list and to add selected risks to its list. The department reported that NOAA has established a consolidated programwide risk list that is to be used to evaluate risks during monthly internal and external reviews. Further, NOAA acknowledges the risks associated with unfilled leadership positions and insufficient management reserves and is working to mitigate these risks. However, the department disagreed with our recommendation to manage and mitigate the risk that NOAA has insufficient insight into NASA's contracts. The department cited an unparalleled level of transparency between the two agencies and listed multiple regular meetings that the two agencies hold to ensure close coordination. While an improved working relationship between the two agencies is critical, NOAA has not provided any evidence that it has been able to effectively question and validate data on NASA's contractor performance. Given the past problems that NOAA experienced in obtaining insight into NASA's contracts and the importance of this interagency relationship to the success of the GOES-R program, we believe that this issue should be managed and monitored as a risk.

NOAA also requested that we acknowledge its effort to reconcile its program estimate with the independent estimate and reflect a 20 percent possibility that the program could cost \$1 billion more than the current estimate of \$7 billion, rather than \$2 billion more. We acknowledge this in our report, however, the reconciliation effort is not complete and NOAA did not provide us with a reconciled estimate.

In addition, NOAA provided detailed comments on its cost estimates, which are bulleted below and include our response.

- NOAA asserts that the independent cost estimate of \$9.3 billion at the 80 percent level could only be realized in an extreme situation; and that based on its own cost model, there is a 20 percent probability this extreme situation will occur. The independent estimator's \$9.3 billion figure is not an extreme situation. Rather, it is at the 80 percent level, meaning that there is a 20 percent chance that the cost could be even higher.
- NOAA expressed concern with our use of preliminary independent cost estimates and schedule projections that are more conservative than the current independent analyses indicate. However, NOAA did not provide us its current independent analyses. Further, these current independent analyses were developed through NOAA's negotiations with the independent estimator to modify selected assumptions. We believe that such negotiations could reduce the independence of the estimate and, in turn, diminish its value as a conservative view by experts outside the program office.
- NOAA commented that its reconciled cost estimate is within 4 percent of the independent estimate's mean (50 percent) value, and that this difference is well within a standard margin of error for cost estimates at this phase of the program. While we are not prescribing a specific level of risk that NOAA should assume, it should be noted that at the 50 percent confidence level, there is a 50 percent chance of being under or over budget. Throughout our report, we have chosen to report the independent estimate at the 80 percent confidence level.
- NOAA also commented that the schedule difference between the independent estimate and the program estimate is currently 11 months and that the program estimate is considered reasonable by

the independent estimator. However, the agency compared its projected launch date (December 2014) to the independent estimator's projected launch at 50 percent confidence (October 2015), instead of at its 80 percent confidence (March 2017). As such, our report accurately depicts the results of this analysis at the 80 percent confidence level.

In the department's comments, NOAA also disagreed that the ABI instrument contractor's low level of management reserve would likely lead to cost growth on the overall GOES-R program. In particular, it noted that the flight project office is expected to maintain a reserve of 20 percent of the "cost to go" (the remaining funds) of the overall space segment, which includes ABI. NOAA stated that, as of August 2007, this reserve was at 20 percent. However, with the contractor's management reserve at 1 percent and 40 percent of work remaining, we continue to believe that ABI's situation will likely result in the early depletion of reserves for the overall program. Furthermore, since ABI is the first major initiative in this program and much remains to be done, it is important to ensure that sufficient management reserve is conserved for other key components as the program enters the development phase.

The Department also suggested technical comments which we incorporated as appropriate.

We will be sending copies of this report to interested congressional committees, the Secretary of Commerce, the Administrator of NASA, the Director of the Office of Management and Budget, and other interested parties. In addition, this report will be available at no charge on our Web site at <http://www.gao.gov>.

If you have any questions on matters discussed in this report, please contact me at (202) 512-9286 or by e-mail at pownerd@gao.gov. Contact points for our Offices of Congressional Relations and Public Affairs may be found on the last page of this report. GAO staff who made major contributions to this report are listed in appendix III.

A handwritten signature in cursive script that reads "David A. Powner". The signature is written in black ink and is positioned above the printed name and title.

David A. Powner
Director, Information Technology
Management Issues

Appendix I: Objectives, Scope, and Methodology

Our objectives were to assess the status and revised plans for the Geostationary Operational Environmental Satellites-R series (GOES-R) procurement and to evaluate whether the National Oceanic and Atmospheric Administration (NOAA) is adequately mitigating key technical and programmatic risks facing the GOES-R program.

To assess the status and the revised plans for the GOES-R procurement, we evaluated various programmatic and technical plans, management reports, and other program documentation. We reviewed the acquisition strategy, cost estimates performed by the program office and an independent estimator, planned system requirements, and monthly executive-level management briefings. We also analyzed earned value management data obtained from a key instrument contractor to assess performance against cost and schedule targets. Furthermore, we interviewed agency officials from NOAA, the National Aeronautics and Space Administration (NASA), and ITT Corporation to determine key dates for future GOES-R acquisition efforts and milestones and progress made on current instrument development efforts.

To evaluate whether NOAA is adequately mitigating key technical and programmatic risks facing the GOES-R program, we analyzed relevant cost reports and risk management plans to identify key risks that could negatively affect the program's ability to acquire the GOES-R system and the mitigation plans for these risks. We also met with technical experts in system acquisitions and relied on our past body of work on other major satellite acquisitions (such as the previous GOES series and the National Polar-orbiting Operational Environmental Satellite System programs) to identify other key risks. We applied lessons learned and also interviewed agency officials to evaluate the adequacy of NOAA's mitigation efforts.

We conducted our work at NOAA and NASA offices in the Washington, D.C., metropolitan area and at ITT Corporation (the contractor for the most critical GOES-R instrument) in Fort Wayne, Indiana. We performed our work from April 2007 to September 2007, in accordance with generally accepted government auditing standards.

Appendix II: Comments from the Department of Commerce



THE SECRETARY OF COMMERCE
Washington, D.C. 20230

October 4, 2007

Mr. David A. Powner
Director, Information Technology
Management Issues
U.S. Government Accountability Office
441 G Street, N.W.
Washington, D.C. 20548

Dear Mr. Powner:

Thank you for the opportunity to review and comment on the Government Accountability Office's draft report entitled *Geostationary Operational Environmental Satellites: Progress Has Been Made, but Improvements Are Needed to Effectively Manage Risks* (GAO-08-18). On behalf of the Department of Commerce, I enclose the National Oceanic and Atmospheric Administration's comments to the draft report.

Sincerely,

A handwritten signature in black ink, appearing to read "Carlos M. Gutierrez".

Carlos M. Gutierrez

Enclosure

Department of Commerce
National Oceanic and Atmospheric Administration
Comments on the Draft GAO Report Entitled
“Geostationary Operational Environmental Satellites:
Progress Has Been Made, but Improvements Are Needed to
Effectively Manage Risks”
(GAO-08-18/October 2007)

General Comments

The Department of Commerce’s National Oceanic and Atmospheric Administration (NOAA) appreciates the opportunity to review this report on Geostationary Operational Environmental Satellites, specifically the R-series (GOES-R). The report does a thorough job assessing the overall status of the GOES-R program. However, NOAA is concerned with GAO’s use of preliminary independent cost estimates and schedule projections that are more conservative than the current independent analyses indicate. NOAA has been actively reconciling its Program Office Estimate (POE) with the Independent Cost Estimate (ICE) to ensure both are using similar assumptions in their projections. One significant assumption involves estimated future inflation rates. By using standard NASA and DoD inflation indices, the ICE reduces to \$600 million but still regards higher inflation as a potential risk. In addition, the GOES-R Program Office has added management reserve to its POE for space segment and operations activities. As a result, the independent cost estimator has noted (1) the reconciled program office estimate is within 4 percent of the independent estimate’s mean value, which is the expected value of the cost projection and (2) this difference is well within a standard margin of error for cost estimates at this phase of the program.

The most conservative estimates at the 80 percent confidence intervals bring the POE within 12 percent of the ICE, or \$1.032 billion below the ICE. In addition, the schedule delta between the ICE and the POE is currently 11 months and considered by the independent estimator to be reasonable and within the ability of schedule models to predict. Therefore, NOAA requests that the GAO acknowledge NOAA’s reconciliation efforts and revise its cost and schedule statements in the report to reflect the 20 percent possibility that in the extremes, the program could cost \$1 billion more rather than \$2 billion, and that the first satellite launch could be delayed by one year rather than two.

NOAA Response to GAO Recommendations

The draft GAO report states, “To improve NOAA’s ability to effectively manage the procurement of the GOES-R system, we recommend that the Secretary of Commerce direct the Under Secretary of Commerce for Oceans and Atmosphere to take the following two actions.”

Recommendation 1: “Ensure that the GOES-R program office manages, mitigates, and reports on risks using a program-level risk list that is reconciled with and includes risks from its flight and operational project offices that could impact the overall program.”

NOAA Response: NOAA agrees with this recommendation. In order to manage, mitigate and report on risks, the GOES-R Program Office will maintain a consolidated program-wide risk list and will use this list in internal and external reviews of the program.

NOAA has taken the following steps to address this recommendation:

- The System Engineering and Integration Division of the GOES-R Program Office maintains the program-wide risk list.
- The GOES-R System Program Director (SPD) reviews all risks during monthly reviews of the flight and ground projects.
- The GOES-R SPD briefs the NOAA Program Management Council (PMC) monthly on risks that warrant senior level review and guidance.

Recommendation 2: “Include the following risks on the programwide risk list, develop plans to mitigate them, and report to the senior executives on progress in mitigating them:

- unfilled or temporary GOES-R program leadership positions,
- insufficient program insight on National Aeronautics and Space Administration (NASA) contract performance, and
- insufficient management reserve on the critical Advanced Baseline Imager instrument and at the GOES-R program level.”

NOAA Response: NOAA partially agrees with this recommendation. We agree that the unfilled leadership positions and the insufficiency of management reserves are significant risks. However, NOAA does not concur that it has insufficient program oversight on NASA’s contract performance.

First, NOAA is aggressively seeking to fill the three top GOES-R leadership positions.

- The former GOES-R SPD announced on July 6, 2007, that he would be retiring. NOAA’s National Environmental Satellite, Data, and Information Service immediately appointed the Deputy Assistant Administrator for Systems, an individual with extensive GOES-R experience, as Acting SPD and began the recruitment process for a new SPD. NOAA advertised this position beginning on August 1, 2007, with closure on September 17, 2007, and plans to select the new SPD within weeks.
- The Deputy SPD position became vacant in April 2007. NOAA immediately appointed a senior headquarters staff advisor, with extensive GOES-R experience, as Acting Deputy SPD. NOAA advertised the position in May and June 2007. No selection was made; therefore, the position has been re-advertised.
- The Assistant SPD position became vacant in May 2007. Following a competitive selection process, the new Assistant SPD reported on September 4, 2007.

The tracking and reporting of all GOES-R personnel actions is a major focus area during the monthly program reviews by the NOAA Program Management Council. The GOES-R program tracks personnel actions through all steps of the recruitment process: initiation of the recruitment package through the vacancy posting, certificate issuance, job interviews, and the employee reporting on-board.

Second, NOAA agrees that management reserves should be a watch item on the program-wide risk list. The GOES-R program has adopted the strategy below for managing its reserves. This strategy has been successful for other programs.

- In accordance with standard NASA practice, the GOES-R program maintains reserves at the program and project levels – not at the individual instrument level. Each project has its own reserve funds and the SPD hold additional reserves. There is no management reserve funding specifically assigned to the Advanced Baseline Imager (ABI). The government-held ABI management reserve is contained within the overall Flight Project and GOES-R program reserves.
- The GOES-R Flight Project Manager’s strategy for instrument development is to aggressively manage instrument costs and minimize the allocation of reserves to the instrument contractors until the need arises. This philosophy calls for tight management and oversight by the Flight Project Manager with re-baselining as necessary to allocate management reserves to the contracts. This process ensures the project is actively involved in cost oversight and contractors do not expend management reserves without the necessary government oversight. When the instrument contractors experience problems causing their costs to exceed their contract values, the GOES-R program has budgeted adequate reserves to meet the development challenges.

Given this management approach, NOAA disagrees with GAO’s finding that “the contractor for the ABI instrument has a very low level of reserve funding for unexpected costs, which means that any unexpected problems will likely lead to cost growth on the overall GOES-R program.” The reserve posture of ABI has to be evaluated in its larger context: the Flight Project is expected to maintain a 20 percent reserve on the “cost to go” of the overall GOES-R space segment, which includes ABI, and to report variances against that reserve. As of August 2007, the project reserve was at 20 percent.

Third, NOAA does not agree with the statement that “insufficient program insight on NASA contract performance” exists.

- For previous GOES programs, NOAA maintained a small liaison office, but did not engage in the day-to-day oversight of NASA contract management. NOAA learned some useful lessons from not having sufficient insight into the performance of NASA’s contractors. Unlike those earlier management arrangements, the GOES-R program is now managed by a joint NOAA-NASA Program Office with NOAA and NASA personnel working side-by-side at all levels of the organization, giving NOAA unprecedented insight into NASA’s contracts.

- The NASA-led Flight Project, which is responsible for the spacecraft and instrument contracts, undergoes four formal reviews each month, all of which address contractor performance:
 1. NOAA's Program Status Review (PSR) – The SPD conducts an in-depth PSR, which is open to all GOES-R program and project staff. The PSR objectives include a review of all spacecraft and instrument risks, issues, status, resources, and mission assurance items.
 2. NASA's Goddard Space Flight Center (GSFC) Program and Projects Directorate Monthly Status Review (MSR) – The SPD or Deputy SPD attends these meetings.
 3. NASA's GSFC PMC MSR – The SPD is a member of the GSFC PMC for the GOES-R portion of the meeting.
 4. NOAA's PMC – The SPD, the Flight Project Manager, and the Ground Project Manager each present information to NOAA leadership on all GOES-R program contracts, their financial performance, risks and issues. Senior NASA officials participate in the NOAA PMC to provide immediate responses to any concerns raised by the NOAA leadership.

- In addition to the formal reviews, there are regular and frequent interactions between the co-located NOAA-led Program Office and the NASA-led Flight Project, including weekly senior management team meetings and weekly risk meetings. The GOES-R Budget Officer, a NOAA official, and his staff provide regular oversight of Earned Value Management on the NASA acquisition and operation contracts. Ad hoc meetings on numerous topics are facilitated by the two staffs being co-located in the same suite of offices at GSFC.

There is unprecedented transparency between NOAA and NASA for GOES-R, as documented in the NOAA-NASA Memorandum of Understanding dated June 15, 2007. Daily interactions between the NOAA and NASA staffs occur with a free exchange of information enabling the NOAA-led Program Office to carry out its management and oversight responsibilities.

Appendix III: GAO Contact and Staff Acknowledgments

GAO Contact

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Staff Acknowledgments

In addition to the contact named above, Colleen Phillips (Assistant Director), Carol Cha, Neil Doherty, Nancy Glover, Mustafa Hassan, Karen Richey, and Teresa Smith made key contributions to this report.

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