U.S. HOUSE OF REPRESENTATIVES
COMMITTEE ON SCIENCE AND TECHNOLOGY
SUBCOMMITTEE ON ENERGY AND ENVIRONMENT

HEARING CHARTER

GAO's Report on the Status of NOAA's Geostationary Weather Satellite Program

Tuesday, October 23, 2007
2:00 - 4:00 P.M.
2318 Rayburn House Office Building

Purpose

The Subcommittee on Energy and Environment meets on October 23, 2007, to continue oversight on the next-generation Geostationary Operational Environmental Satellite (GOES) program. The Government Accountability Office has been continuing its evaluation of progress made by the National Oceanic and Atmospheric Administration at the request of the Subcommittee, and will release their new report.

Witnesses

Mr. David Powner, Director, Information Technology Management Issues, Government Accountability Office

Mr. Powner is the head of the GAO team that has supported the Subcommittee's oversight of NOAA's major satellite programs for the past five years. GAO will discuss the findings and recommendations on NOAA's management of the GOES-R satellite program in the report it will release at the hearing.

Ms. Mary Ellen Kicza, Assistant Administrator for Satellite and Information Services, NOAA

Ms. Kicza leads the National Environmental Satellite, Data and Information Systems (NESDIS) at NOAA, which operates both the geostationary and polar constellations of weather satellites. Formerly NASA's Associate Deputy Administrator for Systems Integration, she was hired by NOAA to bolster efforts to improve satellite program management in the wake of the severe problems suffered by the National Polar-Orbiting Operational Environmental Satellite (NPOESS) program. Ms. Kicza now has the responsibility for execution of the GOES program to be discussed today, and will provide NOAA's response to the GAO report.

Background

Watching the Western Hemisphere

GOES satellites orbit 22,300 miles above the Earth's equator, an altitude where their orbital velocity matches the speed of Earth's rotation. As a result, these satellites maintain the same relative position over a particular point on the planet, and can look down to take pictures of weather patterns over the entire Western Hemisphere. A prototype satellite was launched in 1974; the first GOES satellite went into orbit in 1975. Today, normal practice has two GOES satellites in orbit simultaneously, with one focused on each of the U.S. coasts (GOES-11 and GOES-12). A third (GOES-13) is also kept in space as a spare to assure uninterrupted coverage.

These satellites are NOAA's primary sources for images and other data that support the National Weather Service units forecasting severe weather. The Severe Storm Center uses GOES to track tornadoes, hailstorms and other weather events threatening life and property over land. For the Hurricane Center, GOES can allow them to see developing storms in the areas of the oceans where there are no other observational sensors. Nightly weather reports at the Nation's local weather stations regularly bring GOES pictures into homes across America. GOES would probably be the one satellite NOAA's forecasters would vote to save if they were allowed to keep only one.

Keeping the Orbital Slots Full

The current GOES-R development program is the third major procurement for GOES satellites since NOAA assumed responsibility for funding its own geostationary operational satellites in 1982. In the previous instances, NOAA purchased 5 GOES-Next satellites in the period from1985-2001, and then contracted for four GOES-N satellites for the years 1998-2001. The first GOES-N model launched in May 2006 to be the on-orbit spare[1] while GOES-O and GOES-P have been completed and are in storage for later launches. NOAA in 2002 decided not to complete the GOES-Q satellite because the existing satellites were exceeding their expected lifetimes by significant margins.

The GOES-R program was to represent the first major upgrade to the satellite sensors since GOES-8 went into orbit in 1994. As originally planned, NOAA would buy **four satellites** and intended to spend **$6.2 billion** for the life-cycle period 2007-2020. **Launch of the first satellite was expected in 2012**. As it had with the NPOESS program, NOAA issued instrument contracts with the intent to later transfer them to the contractor that would win the prime contract for the overall satellite system. NOAA also intended to take on the overall responsibility for procurement of the entire satellite system, including the spacecraft, instruments, ground systems and integration. NOAA told GAO that this management structure would "…streamline oversight and fiduciary responsibilities…"[2]

[1] While on the ground, GOES satellites have a letter designation based on the order in which they were built. After launch, checkout and acceptance testing in orbit, it is changed to a number. Therefore, GOES-N is now identified as GOES-13.

[2] Statement of David Powner before the Subcommittee on Energy and Environment, September 29, 2006; p. 9.

in the program and overcome barriers that NOAA believed "…limited the agency's insight and management involvement in the procurement of major elements of the system."[3]

By the time the Committee met for GAO's first report on the GOES-R program last September, some significant changes had been made. NOAA Administrator Lautenbacher informed Members that the cost estimate for the original program had risen to **$11.4 billion**. As a result, the agency **reduced the number of satellites to be purchased by half, to two**. The **second major instrument, the Hyperspectral Environmental Suite, was removed** because the technical challenge was deemed too great. Finally, **first launch availability would now be December 2014**. With these changes, the program's new life-cycle (2003-2028) cost estimate reflected in the President's FY2008 budget request, was **$6.96 billion**.

Responding to recommendations from an Independent Review Team (IRT) chaired by former Lockheed Martin President Tom Young, NOAA also determined in March that the GOES-R program should not follow the same acquisition strategy as NPOESS. Rather than a single prime contractor, there would be a contract for space systems managed for NOAA by NASA's Goddard Space Flight Center and a separate contract for those system elements on the ground to be managed by NOAA. The IRT argued that this would allow NOAA to benefit from the expertise in both agencies. Instruments for the spacecraft would be acquired by NASA and supplied as Government-furnished equipment to the satellite contractor. NASA should take on the responsibility for system integration. GOES-R was the first program to be taken on by a new Program Management Council at NOAA, where senior agency managers from NOAA would review progress on a monthly basis. Space elements will also undergo review by management councils at Goddard Space Flight Center.

GAO's Progress Report

I. Does NOAA buy GOES-R?

GAO's first finding is that the change in acquisition strategy has delayed NOAA's decision to move forward on the acquisition of GOES-R, originally planned for last month. This would have the effect of stalling the competitions for both program segments (the space segment contract was expected to be releases in May 2008, followed by the ground system contract in August 2008). According to a briefing for Committee staff on September 21, the Independent Review Team reported to NOAA that they believed the ground system segment definition was some 6-12 months behind the point it needed to be to permit the agency to seek bidders. NOAA now has a tiger team at work to satisfy the IRT concerns. The agency hopes to be able to minimize the differences in schedule between the two system elements.

With the effort NOAA has devoted to the GOES-R program, it is highly unlikely that a decision would be made not to go forward at this point. However, it is a reasonable

[3] *Supra*.; p. 8.

question to ask whether the increase in capability offered by the proposed program justifies the significant increase in cost per satellite. Originally the GOES-N series of satellites was to incorporate new capabilities beyond those provided by GOES I-M. Instead, they proved to be quite similar in capability to their predecessors. What would be the cost to NOAA of a decision not to pursue GOES-R in favor of continued purchases of the existing GOES design? How difficult would it be to carry out that decision?

II. What Will GOES-R Cost?

Cost estimating is the bane of large, complex programs at Federal agencies, particularly when technical boundaries are being challenged. GAO reports that the cost estimates prepared by the program office and by an independent team differed by some $2.4 billion - while the program office continued to cost the program at $6.9 billion, the independent team concluded that the program as currently designed would cost $9.3 billion. Both estimates are reported at the 80% confidence level (i.e.; there is an 80% chance that if all of the assumptions in the cost models prove accurate, then the program will ultimately cost the amount calculated by the respective models).

GAO concluded, after reviewing the materials provided by NOAA, that the $6.9 billion estimate is likely to rise. NOAA vigorously challenges GAO's conclusion. The agency questions GAO's evaluation of the inflation assumptions used in both estimates, and notes that as the agency has worked to reconcile the different estimates, the independent team's estimate in this area now uses DOD-standard inflation assumptions and is now $600 million above the program office estimate. NOAA stated in its response to GAO that "[t]he most conservative estimates at the 80% confidence intervals bring the [program office estimate] within 12 percent of the ICE [independent cost estimate], or $1.032 billion below the ICE [$9.3 billion]." If NOAA's statement is accepted as accurate, this indicates that the **reconciled cost estimate to be submitted in the FY 2009 President's budget request it will be somewhere in the vicinity of $8 billion - $1 billion over the current estimate.**

GAO also reports that the independent cost estimating team is skeptical of the December 2014 launch availability for GOES-R. They believe there is an even chance that GOES-R would be ready for launch in October 2015, and an 80% chance that March 2017 will be the date. Again, NOAA responds that there is only an 11-month difference between the program's December 2014 date and the independent estimators accept this as reasonable. GAO believes that the date should be compared to the later March 2017 date, which represents the 80% confidence level.

III. Tracking Risk

GAO discussed the current types of risks being tracked by the GOES program office and the managers of the space and ground segment. There are no high-risk (where something that could seriously disrupt the program is judged to have a high probability of happening) issues currently identified, and NOAA has already addressed some, such as solidifying the program requirements document.

GAO noted that the risk analysis for the ground segment identified "…schedule interdependencies between the flight and operations projects offices as a medium criticality risk, but that neither the flight project office or the program identified this risk even though it is relevant to both." GAO recommended that NOAA maintain a program-level list of risk; NOAA has agreed and has made this a responsibility of the systems integration division. The Program Director will also provide monthly updates to the NOAA Program Management Council on the full risk list.

GAO also recommended adding three other risks to the new consolidated list. The first involved vacancies in key management positions. The System Program Director (SPD) is currently operating in an acting role (although she has extensive experience with GOES-R as a result of her position as Deputy Assistant Administrator for Systems in NESDIS). The Deputy System Program Director position is also filled in an acting role. The new Assistant SPD went on duty on September 4. NOAA is currently running a competition for the Program Director and will begin a new one for the Deputy position (no acceptable candidate was selected after the first competition). The need for stable, long-term expertise in leadership positions for programs like GOES-R is often cited as a lesson learned from previous program failures.

In its report, GAO notes that the Advanced Baseline Imager (ABI), the most critical sensor aboard GOES-R, is operating with only a 1% management reserve held by the contractor. This is, of course, far too low; reserves for instrument development normally are no lower than 20%. NOAA responds that the GOES-R program will maintain reserves in both of the project offices and at the program level. Instrument contractors will draw reserves from the overall reserve maintained by the Flight Project and, if necessary, from the Program Office. The acting Program Director believes this plan requires extensive and continuing oversight by the Flight Project Manager in order to avoid depleting that reserve, and to allow NOAA to keep control of the reserve. GAO noted that the ABI has already suffered from technical and cost challenges that have led to one rebaselining and call on the Project Office reserve. The Project Office reserve dropped to 15% in July, although NOAA indicated in its comments that it has been increased to 20%. GAO estimates that the ABI program has some 40% of its work remaining and believes that the impact it has had on the existing reserve, even before GOES-R enters the development and production phase, indicates trouble in the future.

Finally, GAO and NOAA disagree about the level of insight NOAA has into NASA's management of the program's space segment. In July 1991, reviewing the development of the GOES-Next satellites (what became the I-M satellites currently in service), GAO reported to the Committee that the project was in serious trouble. Among the reasons was that NOAA did not require NASA to conduct appropriate engineering analyses before development of the satellites began (due to fiscal constraints and pressure to make the new satellites available for launch). Senior officials in the National Weather Service also said that NESDIS and NASA did not tell them that the solution to the instrument-pointing accuracy requirements would be very complex and difficult to accomplish. One

of the reasons NOAA originally intended to serve as the program integrator was to overcome such communication problems.

GAO believes that the interagency agreement NOAA and NASA reached to govern the GOES-R program does not give NOAA - which is responsible for funding and executing the program - enough knowledge of contractor performance in the space segment managed by NASA. While NOAA receives contractor cost data from NASA, GAO questions if it is sufficient for NOAA to raise questions about its validity only with NASA. NOAA's response argues that with NOAA persons working in the Flight Project office at Goddard Space Flight Center, there will be extensive day-to-day oversight. The Program Office and Flight Project office will interact regularly. Further, NOAA personnel will participate in the NASA technical reviews during the program even before the monthly Program Management Council review at NOAA Headquarters. This is a risk that involves the differing cultures of the two agencies and will be reduced as NOAA assigns personnel with the appropriate technical expertise and experience to its positions in the GOES-R management structure.

The Sounder of Tomorrow

As noted earlier, one of the major changes to the GOES-R program was the decision to eliminate the Hyperspectral Environmental Suite (HES). This instrument was intended to enhance the ability to look down through the atmosphere to determine the temperature and moisture levels at various altitudes. Such data are critical inputs to forecasting models used by the National Weather Service. In the case of hurricane forecasting, the sensor is being designed to provide more refined measurements of winds surrounding the core of hurricanes to identify steering winds and better predict the storm's path. HES was also intended to improve our capability to monitor the waters of the continental shelf and coastal areas. NOAA states that it will be possible to use the Advanced Baseline Imager, combined with data from weather balloons and other sensors, to obtain results equivalent to that produced by the sounder now aboard the existing GOES satellites to meet the agency's needs when GOES-R becomes operational.

The recent National Research Council Earth Science Decadal Survey recommended that "…NOAA develop a strategy to restore the previously planned capability to make high temporal- and vertical-resolution measurements of temperature and water vapor from geosynchronous orbit."[4] At the time, NOAA had three contracts to identify ways to reduce risk in the HES instrument outstanding, and the Survey members suggested extending them to seek some option for providing improved sounding capability on GOES-R. While NOAA ultimately decided to allow the contracts to expire, the contractors involved have stated to Committee staff that sufficient insight has been gained to demonstrate an improved sounder aboard GOES-R. Although it would not be capable of meeting the original requirements for HES, it would represent a marked improvement over the existing sounder. However, in April, Administrator Lautenbacher

[4] National Research Council. *Earth Science and Applications from Space: National Imperatives for the Next Decade and Beyond*. National Academies Press, 2007; p. 2-11.

announced there would be no new geostationary capability until at least GOES-T. Ms. Kicza stated at the time that alternatives for a future sounder would be explored.[5]

NOAA has now cancelled a major instrument on each of its next-generation satellite systems after investing significant resources (the Conical Microwave Imaging Sounder on NPOESS being the other), thereby reducing the chance for improved performance over existing satellites. In both cases, the agency said that the instruments proved too challenging. It emerged later, however, that in both cases it was the pursuit of a particular measurement (ocean color for HES and soil moisture for CMIS) that proved to be the bottleneck. NOAA's process for developing requirements and managing the trade-offs invariably required when operating on technology's leading edge proves the perceptiveness of Voltaire's observation that "the best is the enemy of the good." One of the key issues for the Committee is to examine how we can improve the process for developing and acquiring advanced technologies for environmental monitoring and weather forecasting while maintaining cost control over the development and acquisition of satellite systems.

[5] Iannotta, Ben. "Temperature and Humidity Sounder Will Not Fly on GOES-R." *Space News*, April 16, 2007; p. 10.