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

HEARING CHARTER

From NPOESS to JPSS: An Update on the Nation's Restructured Polar Weather Satellite Program

Friday, September 23, 2011
10:00 AM - Noon
2318 Rayburn House Office Building

Purpose

Polar-orbiting weather satellites are a fundamental aspect of our Nation's forecasting abilities. The purpose of this hearing is to review the impact of the Administration's decision to restructure the National Polar-orbiting Operational Environmental Satellite System (NPOESS) program as well as the progress made to develop the Joint Polar Satellite System (JPSS) program. The Committee is also interested in further understanding the cost, schedule, and performance capabilities associated with the new polar-orbiting weather satellite program.

Since 2003, there have been eight hearings before the Science, Space, and Technology Committee or its subcommittees on the subject of NPOESS or JPSS. During this time, the Government Accountability Office (GAO) has played an invaluable role in monitoring the program and providing regular briefings and yearly reports. While the GAO is not ready to release a report at the time of the hearing, they are prepared to update the Committee on the status of their work to date. With the scheduled launch of the NPOESS Preparatory Project (NPP) next month, the drastic reorganization of the NPOESS program recently completed, and the present austere and uncertain funding environment, the Committee believes it is important to maintain its oversight of the JPSS program which finds itself significantly over budget, behind schedule, and considerably de-scoped.

Background

Since the 1960s, the U.S. has operated two separate operational polar-orbiting meteorological satellite systems, the Polar-orbiting Operational Environmental Satellite (POES) managed by the National Oceanic and Atmospheric Administration (NOAA), and the Defense Meteorological Satellite Program (DMSP) satellites developed by the Air Force. Polar-orbiting satellites transverse the globe from pole to pole, with each orbit being defined by the time of day they pass over the equator: early morning, late morning, and afternoon. Unlike geostationary weather satellites that offer persistent coverage over an area, each polar-orbiting satellite makes approximately 14 orbits per day and is able to view the entire earth's surface twice per day. Currently, there is one operational POES satellite, two operational DMSP satellites, and a European satellite, called the Meteorological Operational (MetOp) satellite. Collectively, these satellites provide weather data to both the military services and NOAA's National Weather Service (NWS) that are normally no more than 6 hours old.

As part of an attempt to streamline government programs, in 1993, the decision was made to bring together these two satellite systems, thereby creating the National Polar-orbiting Operational Environmental Satellite System (NPOESS) program. Originally estimated to cost $6.5 billion over 24 years, the goal was to reduce duplication, thereby saving $1.3 billion. NPOESS also offered the opportunity for NOAA and NASA to assure continuity of the climate data that both agencies were collecting, and to claim a small portion of the Peace Dividend.[1] Instead, the NPOESS program has been fraught with problems, delays, inefficiencies and severe cost overruns such that in February 2010, the Office of Science and Technology Policy (OSTP) announced a fundamental reorganization of the program.

NPOESS

NPOESS was established in 1994 in order to design, develop, construct and launch satellites into polar orbits so that NOAA and DOD would continue to receive daily data necessary for civilian and military weather forecasting needs. To manage the program, DOD, NOAA, and NASA formed a tri-agency Integrated Program Office (IPO). Despite the operations of the IPO, each of the agencies had individual responsibilities for the program. Responsibility for the overall management of the system and satellite operations was assigned to NOAA. The DOD was responsible for acquisition of the sensors, bus, and launch vehicle, and NASA was responsible for facilitating the development and incorporation of new technologies. In order to reduce the risk involved with developing and deploying brand new sensor technologies, the program planned to launch a demonstration satellite called the NPOESS Preparatory Project (NPP) in May 2006. The idea behind NPP was to test the viability of the new sensor technology and to validate and calibrate the sensor data collected against the existing NASA, NOAA and DOD satellites prior to the launch of the first operational satellite planned for 2008.

The Science, Space, and Technology Committee began serious oversight efforts in 2003, helping to reveal major performance problems and schedule delays for the primary imaging instrument, which caused significant cost overruns, all tied to a management structure that delayed rather than fostered decisions at critical moments. At the time, the life-cycle cost for NPOESS was roughly $6.5 billion, with the first of six satellites expected to be launched in 2009.

In 2005, the growth in cost estimates exceeded statutory limits triggering a Nunn-McCurdy[2] recertification. The recertification resulted in the elimination of two satellites and removal or

[1] "NPOESS Lessons Evaluation," Aerospace Corporation, December 1, 2010.
[2] As set forth in the Memorandum of Agreement governing the NPOESS program, the Air Force managed the acquisition of the satellites. NPOESS was therefore subject to Department of Defense regulations for major defense programs. When such programs exceed approved baseline costs by more than 25 percent, recertification is required by 10 U.S.C. 2433 *et seq*.

downgrading of sensor capabilities - decisions driven by the Pentagon. Throughout 2006, NOAA, DOD and NASA worked to realign priorities within the restructured satellite system. Despite the similar goals of continuity of data and access to real-time weather information, NOAA and DOD differed when it came to climate-related sensors. NOAA wanted additional sensors; DOD did not consider these additional sensors a requirement, and they were removed as nonessential in the Nunn-McCurdy process. Only sensors that survived recertification would be equally funded by NOAA and DOD. Any additional sensors desired by NOAA required that full funding would come from NOAA's budget for development and incorporation of these climate sensors into the satellite system.

By 2009, the life-cycle estimate had grown to at least $14.9 billion for four satellites, the first of which would launch in 2014, and the DOD contracted with an Independent Review Team (IRT) to conduct an analysis of the chances of success of the NPOESS program. On June 1, 2009, the IRT issued a report with key findings about the program. The report determined that the current NPOESS program had an extraordinarily low probability of success.[3] The IRT also stated that although continuity of data was a critical priority for all agencies involved, it was at significant risk of gaps that could last for years. Finally, the IRT determined that NPOESS was being managed with cost as the most important parameter and not mission success. At a Science and Technology Committee hearing on June 17, 2009, witnesses testified before the Committee that program leadership had deteriorated to the point that only White House intervention would assure that there would ever be any NPOESS satellites at all.

Rather than trying to satisfy the needs of three agencies with one satellite design, OSTP[4] instructed that the program be cut in two. Satellites flying in orbits to collect early-morning observations would be developed and launched by DOD. NOAA would do the same to collect observations in the afternoon orbit. NOAA would operate all the satellites while in orbit,[5] and would manage the common data system to receive, store and share all data. The late morning orbit was completely abandoned to the Europeans; the EUMETSAT Polar System is now responsible for this orbit.

JPSS

OSTP's announcement in February 2010 to split the NPOESS program included a new name for the program at NOAA, the Joint Polar Satellite System (JPSS). On March 12, 2010, OSTP issued a description of the implementation plan for the new program (see attachment A). The requirements for data to be collected did not change. NASA and NOAA are to continue preparing the NPP satellite for launch in October 2011 to avoid losing data coverage in the afternoon. NOAA will reimburse NASA to manage the JPSS program at the Goddard Space Flight Center.[6] The Air Force will assume the responsibility for managing the newly formed

[3] NPOESS Independent Review Team, Final Report. June 1, 2009.
[4] In concert with the Office of Management and Budget and the National Security Council.
[5] NOAA took on operating responsibility for Defense Meteorological Satellite Program (DMSP) satellites in 1998.
[6] It remains to be seen how effective NASA will be in managing JPSS, as GAO listed NASA Acquisition Management on its 2011 'High Risk' Series because of "persistent cost growth and schedule slippage in the majority of its major projects."

Defense Weather Satellite System (DWSS) program through the Space and Missile Systems Center.

Figure 1.

Comparison of NPOESS to JPSS				
Key Area	**NPOESS Established under PDD NSTC-2 (1994)**	**NPOESS post Nunn-McCurdy (June 2006)**	**NPOESS as of February 2010**	**JPSS[d]**
Life-cycle range	24 years	1995-2026	1995-2026	1995-2024
Estimate life-cycle cost	$6.5 Billion	$12.5 billion	$13.95+ billion baseline[a] ($16.4 billion LCC estimate in NOV 2009)	$12.126 billion (Roughly $17.126 billion if DWSS is included)
Launch schedule	Plan called for six satellites in three orbits	NPP by JAN 2010 C1 by JAN 2013 C2 by JAN 2016 C3 by JAN 2018 C4 by JAN 2020	NPP no earlier than SEP 2011 C1 by MAR 2014[b] C2 by MAY 2016 C3 by JAN 2018 C4 by JAN 2020	NPP no earlier than SEP 2011 JPSS-1: 1Q FY2017
Number of sensors	13 instruments—consisting of 10 environmental sensors and 3 subsystems	NPP: 4 sensors C1: 6 sensors C2: 2 sensors C3: 6 sensors C4: 2 sensors	NPP: 5 sensors C1: 7 sensors[c] C2: 2 sensors C3: 6 sensors C4: 2 sensors	NPP: 5 sensors[e] JPSS-1 and JPSS-2 will have at least 5 sensors

SOURCE: GAO analysis of NOAA, DOD, and task force data (update by Committee with data from NOAA)
[a] Although the program baseline was $13.95 billion, GAO estimated in June 2009 that this cost could grow by about $1 billion. In addition, officials from the Executive Office of the President stated that they reviewed life-cycle cost estimates from DOD and the NPOESS program office of $15.1 billion and $16.45 billion respectively.
[b] Officials from the executive office of the President noted that the expected launch date of C1 had slipped to late 2014 by the time of their decision. NOAA has since indicated that the launch readiness date had slipped to December of 2015.
[c] In May 2008, the NPOESS Executive Committee approved an additional sensor, the Total Spectral Solar Irradiance Sensor for the C1 launch.
[d] This does not account for DWSS which is estimated to cost roughly $5billion through 2015 (based on GAO's 2010 report).
[e] These five sensors are: VIIRS, CrIS, OMPS-nadir, the Advanced Technology Microwave Sounder, and the Cloud and Earth's Radiant energy System/Earth Radiation Budget Sensor.

Issues

Cost

Throughout the history of the program, cost growth has consistently been a challenge. Plagued by increasing requirements, unrealistic cost-estimates, and multiple re-baselinings, the program has experienced almost yearly cost increases. It is such a perennial problem that NOAA still does not have an updated baseline, and does not expect to have one complete until February 2012. This baseline, which should delineate the program's functionality and cost, is required under P.L. 110-161 and P.L. 109-155.[7]

[7] Brinton, Turner, "White House Asks Congress for More Weather Satellite Money," Space News, December 9, 2010.

This uncertainty has influenced the funding it has received from both Republican and Democratic controlled Congresses. In the FY10 appropriations bill, the last regular appropriation the program received, the accompanying report language stated "the budget request does not reflect the true need and the program's long-term projections for success remain in doubt. In fact, to date this experiment in combining disparate elements has been a horrendous and costly failure."[8] Soon after that appropriations bill was enacted, the Administration radically restructured the program (see figure 1 and Attachment A). Unfortunately, the JPSS Program has only been funded by continuing resolutions since the restructuring, resulting in a funding profile that reflects a program "based on financial projections that have proven to be consistently and abysmally unreliable."[9]

The program currently finds itself in the middle of a metaphorical chicken-and-egg paradigm – on one hand NOAA has indicated that they cannot develop a credible baseline for costs and capabilities without a stable and predicable budget horizon, on the other hand the Congress remains skeptical of entrusting the taxpayers money with a program that has proven to be a poor steward of scarce resources without having firm cost, schedule and performance metrics to hold the program accountable to.

Figure 2. Five Year Budget Profile ($ in millions)

		FY 2008		FY 2009		FY 2010		FY 2011			FY 2012		
		PBR	**Enacted**	**PBR**	**Enacted**	**PBR**	**Enacted**	**PBR**	**CR**	**Spend Plan**	**PBR**	**House**	**Senate**
DOC/ NOAA	NPOESS	331.3 *	331.3*	287.9 *	313.985 *, **	382.2 *	382.2*						
	JPSS							1,060	382.2	471.9	1,070	901.3	920.79
DoD/ Air Force	NPOESS (RDT&E & Proc)	334.9	334.9	289.5	289.5	400.5	400.5	351.8	100.0				
	DWSS (RDT&E)								75.0		444.9	225.0	TBD
NASA	NPP	46.1	46.1	42.2	42.2	82.6	82.6	101.8	101.8		16.1		

SOURCE: NOAA
* Reflects the NOAA portion of the NPOESS budget
** Includes $26M from ARRA

The Administration has responded to this uncertainty by maintaining funding for near-term priorities such as the ground network and keeping NPP on schedule for launch, while delaying work on JPSS-1, and temporarily shutting down work on JPSS-2. This strategy does not come without risks. By postponing important work on JPSS-1 and JPSS-2, the program could be preventing a near-term gap in coverage, only to exacerbate a gap in coverage later in the program's life. NOAA also reprogrammed approximately $90 million from other programs this past summer in an effort to prevent any delays to NPP. Concentrating on near-term risks is

[8] House Report 111–366
[9] *Ibid.*

arguably the best option available, as any delay in NPP could have a significant impact on NPP's cost. In the event of a delay to NPP, launch facility scheduling precludes another attempt before February of 2012, and NPP is in the unique position of being launched on the last Delta 2 vehicle, meaning that all overhead costs would be absorbed by the program.

The current FY12 House Commerce, Justice, Science, and Related Agencies Appropriations bill allocates $901,346,000 for JPSS, which is $429,446,000 above the FY11 level and $168,654,000 below the Administration's FY12 request.[10] The bill passed the House Appropriations Committee, and is now awaiting consideration by the House. The Senate Commerce, Justice, Science, and Related Agencies Appropriations bill provides JPSS with $920,794,000, which is $436,530,000 above the 2011 spend plan.[11] The Senate Committee also directed NOAA to reduce the total life-cycle cost, with the exception of climate sensors, to $9,423,000,000 through 2024. This, if enacted, would only provide $6,060,000,000 for the remainder of the program. The bill passed the Senate Appropriations Committee, and is now awaiting consideration by the Senate.

Gap in Coverage

Data coverage is inexorably connected to funding. Any shortfalls in program funding can only be made up for by scaling back capabilities, which are already near legacy, or delaying the schedule, which would exacerbate the gap in coverage that the program could already be facing. It remains unclear what impact additional funding would have the program at this point.

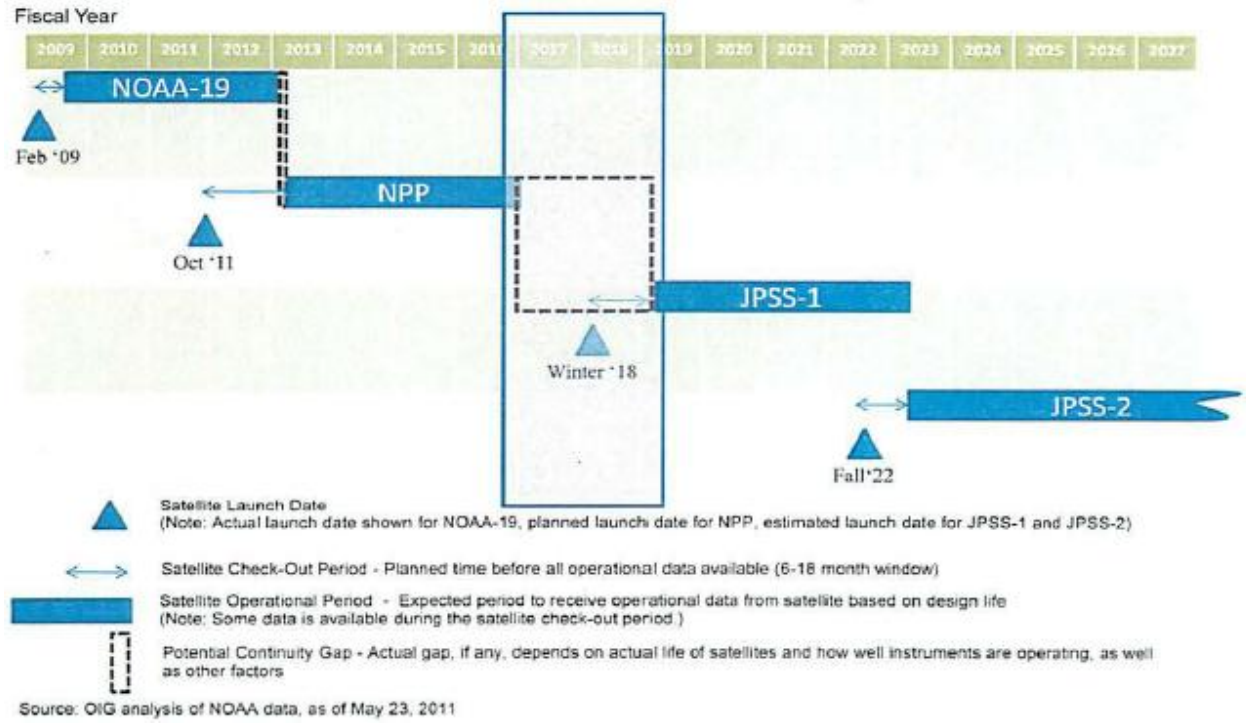
NPP and JPSS were developed to continue the data collection of two NASA research satellites, Terra and Aqua, which were launched in 1999 and 2002 respectively. While they were only expected to operate for six years, they continue to operate today. This isn't to say that NPP, or JPSS for that matter, can expect to operate that long. NPP was originally designed as an operation test-bed, not an operational satellite, and was only expected to have a mission life of five years. Although the instruments aboard the satellite were designed to last seven years, NASA has indicated that, because the instruments were developed under "an undisciplined environment," they only expect the instruments to last for three years.[12] Based on instrument heritage and engineering confidence, a great deal of uncertainty surrounds the potential mission life of NPP and JPSS, thereby making any gap analysis highly speculative.

NOAA is currently facing two potential gaps in coverage, one would be incurred if NOAA cannot launch and check-out NPP before NOAA-19[13], Terra, and Aqua fail, and the second would be experienced if JPSS-1 is not launched and checked-out before NPP fails (see figure 2).

[10] House Report 112-169
[11] Senate Report 112-78
[12] "NASA's Management of the NPOESS Preparatory Project," Office of the Inspector General, National Aeronautics and Space Administration, June 2, 2011.
[13] NOAA-19 is the last satellite in the POES series.

Figure 3. Potential Continuity Gaps in NOAA's Polar Operational Satellite Programs (Expected Gap Highlighted)

Expected Major Gap (Based on Current FY2011 funding)



Impact to Severe Weather Forecasting

One of the primary rationales NOAA has used to support full funding for JPSS is its impact on the long-term accuracy of predictions for severe weather such as hurricanes, blizzards, and tornadoes. NOAA has argued that without money to continue JPSS, the federal government will no longer be able to forecast severe weather events far enough in advance for communities to take life-saving action.[14] NOAA has supported this position by citing an analysis by National Weather Service that compared the forecasts of the February 2010 northeast blizzard with models that removed data from the afternoon orbit of the polar weather satellites. Their analysis showed that forecasts for DC and the Mid-Atlantic coast that did not contain the polar-orbiting satellite data under-forecasted snow fall by at least 10 inches.[15]

What this analysis did not include, however, was a trade-study investigating whether other forecasting tools such as sensors and data from geostationary weather satellites, weather balloons, ground-based sensors, buoys, aircraft, other earth observing satellites, commercial opportunities, or international partnerships could have off-set the shortfall. The analysis also did not compare the relative investments in each tool or how forecasts could be impacted by

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[14] Rosner, Hillary, "Weather Alerts Are Imperiled, NOAA Warns," the New York Times, August, 17, 2011.

[15] "Impact of Loss of US Polar-orbiting Satellite Data on Nation's High-Impact Weather Forecast Capability," National Centers for Environmental Prediction, National Oceanic and Atmospheric Administration.

alternative investment portfolios. The use of individual case-studies is also limited in its usefulness because it makes sweeping generalizations based on limited data. Despite the shortfalls of the admittedly cursory review, data derived from polar-orbiting weather satellites are clearly an irreplaceable aspect of our Nation's weather forecasting capabilities, and any degradation of our current capabilities would result in severe consequences.

NPP as Operational

In addition to the risks associated with NPP relative to the "undisciplined environment" in which its sensors were developed, additional risks exist.[16] As previously noted, NPP was originally designed as an operation test-bed for NPOESS sensors , as well as to continue the collection of global climatology data developed by NASA's Earth Observing System's Terra and Aqua satellites. It was never envisioned to be an operational satellite, however, in March 2009, delays in the expected launch of the first NPOESS satellite led the Executive Committee[17] to decide to use NPP data operationally. Because NPP was never meant to be an operational satellite, its capabilities are below what was expected from the first NPOESS satellite. As GAO noted in its previous report, NPP's limitations include "fewer ground-based data processing systems, fewer security controls, and a shorter satellite lifespan than current or planned operational satellites. These design limitations mean that in some cases, NPP's data will not be as timely and useful as current polar satellites or as secure as planned satellites.[18]

DWSS

Although the management and acquisitions of the defense and civil polar-orbiting weather satellites were separated, the two programs remain dependant on each other for data continuity. Data collected by DWSS in the morning orbit feeds into models and products developed by NOAA. Conversely, the data NOAA collects from JPSS in the afternoon orbit assists the DOD in producing worldwide forecasts for the warfighter. Because of this symbiotic relationship, any delay in the formulation, validation, and certification of DWSS requirements directly impacts NOAA and the JPSS program. The DOD currently has two legacy DMSP satellites in reserve, therefore giving the DOD more time to formulate their follow-on program. The DOD has yet to provide concrete information regarding their plans for DWSS. Unfortunately, this leaves the JPSS program in a state of uncertainty, further compounding risk.

Program Management Structure

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[16] "NASA's Management of the NPOESS Preparatory Project," Office of the Inspector General, National Aeronautics and Space Administration, June 2, 2011.

[17] The Executive Committee was the senior leadership from NASA, NOAA, and DOD responsible for management of the NPOESS program.

[18] "Polar Orbiting Satellites: Agencies Must Act Quickly to Address Risks That Jeopardize the Continuity of Weather and Climate Data," Government Accountability Office, May, 2010.

With the disbanding of the NPOESS Executive Committee and the Integrated Program Office, it remains unclear how decisions will be made in for the follow-on JPSS program. While NOAA is the primary agency responsible for the operational requirements of JPSS, NASA is actually responsible for the program procurement. Despite the great strides made to fill key staff positions, it is unclear how management decisions will be made going forward. This issue is compounded by the fact that both the NOAA and NASA staff for JPSS are growing. The NESDIS budget is approaching roughly one third of the NOAA budget, threatening budgets for other critical NOAA missions, and the NASA JPSS staff is growing significantly at both GSFC and Headquarters. As a result, the chain of command and management control between NOAA, NESDIS, NASA GFC, and NASA headquarters remains unclear.

Commercial Options

The 1992 Land Remote Sensing Policy Act prohibits the Department of Commerce from commercializing weather satellite systems. Section 5671of the bill states:

> Neither the President nor any other official of the Government shall make any effort to lease, sell, or transfer to the private sector, or commercialize, any portion of the weather satellite systems operated by the Department of Commerce or any successor agency.[19]

Recently, many commercial space companies have presented different ideas and concepts for providing environmental data to meet US government requirements. Some of these concepts include hosting Government Furnished Equipment (GFE) such as environmental instruments or sensors on commercial satellites as well as selling commercial environmental data to the US government requirements.

While the core weather satellite mission remains the purview of the USG, there is precedent for the commercial acquisition of environmental data that is not part of the core weather mission. Departments and agencies have purchased ocean color data in the past and are currently purchasing commercial satellite imagery. Additionally, Departments and agencies have hosted GFE sensors aboard commercial satellites, such as the FAA’s Wide Area Augmentation System (WAAS, a transportation navigation system) and the upcoming USAF Commercially Hosted Infrared Payload Flight Demonstration Program (CHIRP). Government agencies, in light of new budgetary realities, are currently analyzing additional commercial alternatives as a means of fulfilling their mission requirements.

Compensation Policy

The recent funding shortfalls, and the potential gaps that they may cause, have led to various agencies and institutions voicing support for the data and products provided by JPSS. These groups have touted the importance of weather forecasting on their own operations, and how full funding is needed regardless of fiscal constraints. The recent Senate Appropriations bill took

[19] Public Law 102-555

note of this support, but also mentioned that "none of these entities have offered any financial support for such an important program." The Committee went on to call for NOAA to be "reimbursed for any special products, services, data transfers, or any activities conducted in collaboration with any Federal agency or non-Federal entity…"[20]

Witnesses

The Honorable Kathryn Sullivan, Ph.D., Assistant Secretary of Commerce for Environmental Observation and Prediction and Deputy Administrator, National Oceanic and Atmospheric Administration

Mr. Christopher Scolese, Associate Administrator, National Aeronautics and Space Administration

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

[20] Senate Report 112-78

Attachment A

Restructuring the National Polar-orbiting Operational Environmental Satellite System
February 1, 2010

The President's FY2011 budget contains a major restructuring of the National Polar-orbiting Operational Environmental Satellite System (NPOESS) in order to put the critical program on a more sustainable pathway toward success. The satellite system is a national priority -- essential to meeting both civil and military weather-forecasting, storm-tracking, and climate-monitoring requirements. However, the program is behind schedule, over budget, and underperforming. Independent reports and an administration task force have concluded that the current program cannot be successfully executed with the current management structure, and with the current budget structure. These challenges originate in large part because of a combination of management deficiencies that result from conflicting perspectives and priorities among the three agencies who manage the program. Serious lapses in capabilities loom as a result.

Background

NPOESS is a tri-agency program with the Department of Commerce (specifically the National Oceanic and Atmospheric Administration, or NOAA), the Department of Defense (DOD, specifically the Air Force), and the National Aeronautics and Space Administration (NASA) designed to merge the civil and defense weather satellite programs in order to reduce costs and to provide global weather and climate coverage with improved capabilities above the current system.

In 2002, the NPOESS program was estimated to cost approximately $6.5B (for development and operations through FY2018) and consisted of an initial NASA satellite to test the new sensors (the NPOESS Preparatory Project – NPP - to be launched in early 2006) and six NPOESS platforms in three orbits, the first of which (C-1) was to be launched in early 2009. The program encountered numerous technical and management challenges, which led to restructuring of the NPOESS program in 2006 due to cost over-runs that triggered Congressionally-mandated recertification. The restructured program reduced the scale of the program from six main satellites (in three orbits) to four satellites (in two orbits). (The U.S. will rely on European satellites for operational weather observations from the remaining orbit.) The NPP launch has been delayed to 2011, and the launch of the first NPOESS platform (C-1) was expected to be in late 2014. (These would each be delays of five years from the original plan.) At that time the new life-cycle cost estimate (through FY2024 due to delays) was approximately $12B for this reduced capability. The current official baseline life-cycle cost estimate is approximately $13.9B.

A new direction for ensuring continuity of polar-orbiting satellite measurements:

After reviewing options, including those suggested by an Independent Review Team (IRT) and Congressional Committees, the President's FY2011 budget takes significant new steps. Today the White House is announcing that NOAA and the Air Force will no longer continue to jointly procure the polar-orbiting satellite system called NPOESS. This decision is in the best interest of the American public to preserve critical operational weather and climate observations into the future.

- The three agencies (DOD, NOAA and NASA) have and will continue to partner to ensure a successful way forward for the respective programs, while utilizing international partnerships to sustain and enhance weather and climate observation from space.

- The major challenge of NPOESS was jointly executing the program between three agencies of different size with divergent objectives and different acquisition procedures. The new system will resolve this challenge by splitting the procurements. NOAA and NASA will take primary responsibility for the afternoon orbit, and DOD will take primary responsibility for the morning orbit. The agencies will continue to partner in those areas that have been successful in the past, such as a shared ground system. The restructured programs will also eliminate the NPOESS tri-agency structure that that has made management and oversight difficult, contributing to the poor performance of the program.

• NOAA and the Air Force have already begun to move into a transition period during which the current joint procurement will end. A detailed plan for this transition period will be available in a few weeks. The agencies will continue a successful relationship that that they have developed for their polar and geostationary satellite programs to date. NOAA's portion will notionally be named the "Joint Polar Satellite System" (JPSS) and will consist of platforms based on the NPP satellite.

• In addition, these Agencies have a strong partnership with Europe through the European Organization for the Exploitation of Meteorological Satellites (EUMETSAT) that will continue to be a cornerstone of our polar-orbiting constellation, and will ensure our ability to provide continuous measurements.

• These changes to the NPOESS program will better ensure continuity of crucial civil climate and weather data in the future. Decisions on future satellite programs will be made to ensure the best plan for continuity of data.

• While the Air Force continues to have remaining Defense Meteorological Satellite Program (DMSP) polar-orbiting satellites available for launch for the next few years, NOAA launched its final polar-orbiting satellite in February 2009. Given that weather forecasters and climate scientists rely on the data from NOAA's current on-orbit assets, efforts will focus development of the first of the JPSS platforms on ensuring both short- and long-term continuity in crucial climate and weather data.

• NASA's role in the restructured program will be modeled after the procurement structure of the successful POES and GOES programs, where NASA and NOAA have a long and effective partnership. Work is proceeding rapidly with NOAA to establish a JPSS program at NASA's Goddard Space Flight Center (GSFC).

- The NASA developed and operating Earth Observing System (EOS) Aqua satellite and ground system are very similar in scope and magnitude to the proposed JPSS program.
- NOAA and NASA will strive to ensure that all current NPOESS requirements are met on the most rapid practicable schedule without reducing system capabilities.
- NASA program and project management practices have been refined over decades of experience developing and acquiring space systems and NASA anticipates applying its current practices to JPSS. NASA program and project management processes will include thorough and ongoing review and oversight of project progress. Cost-estimates will be produced at or close to the 80% confidence level.

• DOD remains committed to a partnership with NOAA in preserving the Nation's weather and climate sensing capability. For the morning orbit, the current DOD plan for deploying DMSP satellites ensures continued weather observation capability. The availability of DMSP satellites supports a short analysis (in cooperation with the partner agencies) of DOD requirements for the morning orbit and solutions with the start of a restructured program in the 4th quarter of fiscal year 2011. While this study is being conducted, DOD will fully support NOAA's needs to ensure continuity of data in the afternoon orbit by transitioning appropriate and relevant activities from the current NPOESS effort.

• We expect much of the work being conducted by Northrop-Grumman and their subcontracts will be critical to ensuring continuity of weather observation in the afternoon orbit. DOD will work closely with the civil partners to ensure the relevant efforts continue productively and efficiently, and ensure the requirements of the national weather and climate communities are taken into consideration in building the resultant program for the morning orbit.

Attachment B

Detailed Instrument Descriptions

CrIS

Cross-track Infrared Sounder (CrIS) is the first in a series of advanced operational sounders that will provide more accurate, detailed atmospheric temperature and moisture observations for weather and climate applications. This high-spectral resolution infrared instrument will take 3-D pictures of atmospheric temperatures, water vapor and trace gases. It will provide over 1,000 infrared spectral channels at an improved horizontal spatial resolution and measure temperature profiles with improved vertical resolution to an accuracy approaching 1 Kelvin (the absolute temperature scale). This information will help significantly improve climate prediction and both short-term weather "nowcasting" and longer-term forecasting. It will also provide a vital tool for National Oceanic and Atmospheric Administration (NOAA) to take the pulse of the planet continuously and assist in understanding major climate shifts. The CrIS instrument is developed by the ITT Corporation, Ft Wayne, Indiana.

OMPS

Ozone in the atmosphere keeps the Sun's ultraviolet radiation from striking the Earth. The Ozone Mapping and Profiler Suite (OMPS) will measure the concentration of ozone in the atmosphere, providing information on how ozone concentration varies with altitude. Data from OMPS will continue three decades of climate measurements of this important parameter used in global climate models. The OMPS measurements also fulfill the U.S. treaty obligation to monitor global ozone concentrations with no gaps in coverage. OMPS is comprised of two sensors, a nadir sensor and limb sensor. Measurements from the nadir sensor are used to generate total column ozone measurements, while measurements from the limb sensor generate ozone profiles of the along-track limb scattered solar radiance. The OMPS instrument is developed by the Ball Aerospace & Technologies Corporation, Boulder, Colorado.

VIIRS

Visible/Infrared Imager Radiometer Suite (VIIRS) will combine the radiometric accuracy of the Advanced Very High Resolution Radiometer (AVHRR) currently being flown on the NOAA polar orbiters with the high spatial resolution (0.56 km) of the Operational Linescan System (OLS) flown on DMSP. The VIIRS will provide imagery of clouds under sunlit conditions in about a dozen bands, and will also provide coverage in a number of infrared bands for night and day cloud imaging applications. VIIRS will have multi-band imaging capabilities to support the acquisition of high-resolution atmospheric imagery and generation of a variety of applied products including visible and infrared imaging of hurricanes and detection of fires, smoke, and atmospheric aerosols. VIIRS will also provide capabilities to produce higher-resolution and more accurate measurements of sea surface temperature than currently available from the heritage AVHRR instrument on POES, as well as provide an operational capability for ocean-color observations and a variety of derived ocean-color products. The VIIRS instrument is developed by the Raytheon Company, El Segundo, California.

ATMS

The Advanced Technology Microwave Sounder (ATMS) will operate in conjunction with the CrIS to profile atmospheric temperature and moisture. The ATMS is the next generation cross-track microwave sounder that will combine the capabilities of current generation microwave temperature sounders (Advanced Microwave Sounding Unit – AMSU-A) and microwave humidity sounders (AMSU-B) that are flying on NOAA's POES. The ATMS draws its heritage directly from AMSU-A/B, but with reduced volume, mass and power. The ATMS has 22microwave channels to provide temperature and moisture sounding capabilities. Sounding data from CrIS and ATMS will be combined to construct atmospheric temperature profiles at 1 degree Kelvin accuracy for 1 km layers in the troposphere and moisture profiles accurate to 15 percent for 2 km layers. Higher (spatial, temporal and spectral) resolution and more accurate sounding data from CrIS and ATMS will support continuing advances in data assimilation systems and NWP models to improve short- to medium-range weather forecasts. The ATMS instrument is developed by the Northrop Grumman Corporation, Azusa, California.

CERES

The CERES measurements seek to develop and improve weather forecast and climate models prediction, to provide measurements of the space and time distribution of the Earth's Radiation Budget (ERB) components, and to develop a quantitative understanding of the links between the ERB and the properties of the atmosphere and surface that define that budget. The observations from CERES are essential to understanding the effect of clouds on the energy balance (energy coming in from the sun and radiating out from the earth), which is one of the largest sources of uncertainty in our modeling of the climate.

TSIS

TSIS measures the variability in the Sun's total output using two sensors. The Total Irradiance Monitor (TIM) is a broadband measurement while Spectral Irradiance Monitor (SIM) measures the spectral distribution of the solar irradiance between 0.2 & 2.7 µm. There is no operational heritage, but this instrument suite will continue the capabilities from the research measurements of TSIS on NASA's SORCE mission.